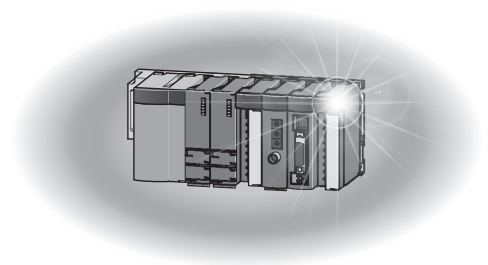# MITSUBISHI ELECTRIC

Mitsubishi Programmable Controller

MELSEC Q series

4Mpps Capable High-Speed Counter Module User's Manual

-QD64D2
-GX Configurator-CT (SW0D5C-QCTU-E)

●SAFETY PRECAUTIONS●

(Read these precautions before use.)

Before using this product, please read this manual carefully and pay full attention to safety to handle the product correctly.

The precautions given in this manual are concerned with this product. For the safety precautions of the programmable controller system, please read the User's Manual for the CPU module.

In this manual, the safety precautions are classified into two levels: "⚠ WARNING" and "⚠ CAUTION".

| ⚠ WARNING | Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury. |
| ⚠ CAUTION | Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage. |

Note ⚠ that the CAUTION level may lead to a serious consequence according to the circumstances.
Always follow the precautions of both levels because they are important to personal safety.
Please save this manual to make it accessible when required and always forward it to the end user.

[DESIGN PRECAUTIONS]

⚠WARNING

● Do not write data to "read-only area" or "reserved area" in the buffer memory of the intelligent function module. Also do not turn ON/OFF the "reserved" signal in I/O signals to the programmable controller CPU.
Doing any of these operations may cause a malfunction of the programmable controller system.

● When a transistor for external output fails, the output may be ON or OFF status.
Create a circuit for monitoring output signal that may lead to serious accident.

⚠CAUTION

● Do not install the control lines and/or pulse input wiring together with the main circuit or power lines, and also do not bring them close to each other.
Keep a distance of 150mm (5.91 inch) or more between them.
Failure to do so may cause a malfunction due to noise.

[INSTALLATION PRECAUTIONS]

⚠CAUTION

● Use the programmable controller in the environment conditions given in the general specifications of the User's Manual for the CPU module.
Failure to do so may cause an electric shock, fire, malfunction, or damage to or deterioration of the product.

[INSTALLATION PRECAUTIONS]

⚠ **CAUTION**
● While pressing the installation lever located at the bottom of the module, fully insert the module fixing projection into the fixing hole in the base unit and press the module using the hole as a fulcrum. Incorrect module mounting may cause a malfunction, failure, or drop of the module. In an environment of frequent vibrations, secure the module with screws.
● The screws must be tightened within the specified torque range. If the screw is too loose, it may cause a drop, short circuit, or malfunction. Excessive tightening may damage the screw and/or the module, resulting in a drop, short circuit or malfunction.
● Be sure to shut off all phases of the external power supply used by the system before mounting or removing the module. Failure to do so may cause damage to the product.
● Do not directly touch any conductive part or electronic part of the module. Doing so may cause a malfunction or failure of the module.

[WIRING PRECAUTIONS]

⚠ **CAUTION**
● For wiring and connection, properly crimp or solder the connector with the tools specified by the manufactures and attach the connector to the module securely.
● Be careful to prevent foreign matter such as dust or wire chips from entering the module. Failure to do may cause a fire, failure or malfunction.
● A protective film is attached to the module top to prevent foreign matter such as wire chips from entering the module during wiring. Do not remove the film during wiring. Be sure to remove it for heat dissipation before system operation.
● Be sure to place the cables connected to the module in a duct or clamp them. If not, dangling cables may swing or inadvertently be pulled, resulting in damage to the module and/ or cables, or malfunctions due to poor cable connection.
● When disconnecting the cable, do not pull it by holding the cable part. Disconnect the cable with connector with holding the connector plugged into the module. Pulling the cable part with the cable still connected to the module may cause a malfunction or damage to the module and/or cable.

[WIRING PRECAUTIONS]

⚠ **CAUTION**
● Always ground the shielded cable on the module side. Failure to do may cause a malfunction. ● Correctly wire cables to the module after checking the rated voltage and terminal layout of the product. Connecting a voltage different from the rated voltage or incorrect wiring may result in a fire or failure.

[STARTUP/MAINTENANCE PRECAUTIONS]

⚠ **CAUTION**
● Do not disassemble or remodel each of the modules. Doing so may cause failure, malfunctions, personal injuries and/or a fire. ● Be sure to shut off all phases of the external power supply used by the system before mounting or removing the module. Not doing so may result in a failure or malfunction of the module. ● Do not mount/remove the module onto/from the base unit more than 50 times (IEC 61131-2 compliant), after the first use of the product. Doing so may cause malfunctions. ● Do not touch the terminal while the power is ON. Failure to do may cause a malfunction. ● Be sure to shut off all phases of the external power supply used by the system when cleaning the module or retightening the terminal or module fixing screws. Not doing so may result in a failure or malfunction of the module. If the screw is too loose, it may cause a drop, short circuit or malfunction. Excessive tightening may damage the screw and/or the module, resulting in a drop, short circuit or malfunction. ● Before handling the module, touch a grounded metal object to discharge the static electricity from the human body. Not doing so may result in a failure or malfunction of the module.

[DISPOSAL PRECAUTIONS]

⚠ **CAUTION**
● When disposing of this product, treat it as industrial waste.

●CONDITIONS OF USE FOR THE PRODUCT●

(1) Mitsubishi programmable controller ("the PRODUCT") shall be used in conditions;

i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and

ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

(2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries.

MITSUBISHI SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI'S USER, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.

("Prohibited Application")

Prohibited Applications include, but not limited to, the use of the PRODUCT in;

• Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.

• Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.

• Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above, restrictions Mitsubishi may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by Mitsubishi and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTs are required. For details, please contact the Mitsubishi representative in your region.

REVISIONS

Print date	*Manual number	Revision
Dec., 2008	SH(NA)-080726ENG-A	First edition
Apr., 2010	SH(NA)-080726ENG-B	Correction SAFETY PRECAUTIONS,GENERIC TERMS AND ABBREVIATIONS, Chapter 1, Section 2.1,Section 2.2, Section 4.4.1, Section 5.3.4, Section 6.2.1 Addition CONDITIONS OF USE FOR THE PRODUCT, Compliance with the EMC and Low Voltage Directives, Section 2.3

INTRODUCTION

Thank you for purchasing the Mitsubishi programmable controller MELSEC-Q series.
Before using the product, please read this manual carefully to develop full familiarity with the functions and performance of the Q series programmable controller to ensure correct use.

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Compliance with the EMC and Low Voltage Directives

(1) For programmable controller system

To configure a system meeting the requirements of the EMC and Low Voltage
Directives when incorporating the Mitsubishi programmable controller (EMC and Low
Voltage Directives compliant) into other machinery or equipment, refer to Chapter 9
"EMC AND LOW VOLTAGE DIRECTIVES" of the QCPU User's Manual (Hardware
Design, Maintenance and Inspection).
The CE mark, indicating compliance with the EMC and Low Voltage Directives, is
printed on the rating plate of the programmable controller.

(2) For the product

For the compliance of this product with the EMC and Low Voltage Directives, refer to
Section 4.4.1 Wiring precautions.

This manual describes the type QD64D2 4Mpps capable high-speed counter module using the following generic terms and abbreviations, unless otherwise specified.

Generic term and abbreviation	Description
QD64D2	Abbreviation for the type QD64D2 4Mpps capable high-speed counter module
CH□	Generic term for CH1 and CH2
Coincidence signal No. m	Generic term for the coincidence signal No. 1 and the coincidence signal No. 2
Coincidence output No. m	Generic term for the coincidence output No. 1 and the coincidence output No. 2
Continuous comparison No.m	Generic term for the continuous comparison No. 1 and the continuous comparison No. 2
Continuous comparison No.1 point n	Generic term for the continuous comparison No. 1 point 1 to the continuous comparison No. 1 point 16
Continuous comparison No.2 point n	Generic term for the continuous comparison No. 2 point 1 to the continuous comparison No. 2 point 16
Continuous comparison No.m point n setting	Generic term for the continuous comparison No. 1 point n setting and the continuous comparison No. 2 point n setting
Comparison point	Generic term for the coincidence output No. m point setting and the continuous comparison No. m point n setting
External coincidence output power supply terminal	Generic term for external coincidence output power supply 12/24V terminal and external coincidence output power supply GND (0V) terminal
Personal computer	Generic term for IBM-PC/AT-compatible personal computer
GX Developer	Product name for MELSEC software packerge
GX Works2	
GX Configurator-CT	Abbreviation for GX Configurator-CT (SW0D5C-QCTU-E) of counter module setting/monitor tool
QCPU (Q mode)	Generic term for the Q00JCPU, Q00CPU, Q01CPU, Q02CPU, Q02HCPU, Q06HCPU, Q12HCPU, Q25HCPU, Q02PHCPU, Q06PHCPU, Q12PHCPU, Q25PHCPU, Q12PRHCPU, Q25PRHCPU, Q00UJCPU, Q00UCPU, Q01UCPU, Q02UCPU, Q03UDCPU, Q04UDHCPU, Q06UDHCPU, Q10UDHCPU, Q13UDHCPU, Q20UDHCPU, Q26UDHCPU, Q03UDECPU, Q04UDEHCPU, Q06UDEHCPU, Q10UDEHCPU, Q13UDEHCPU, Q20UDEHCPU, Q26UDEHCPU, Q50UDEHCPU and Q100UDEHCPU
Redundant CPU	Generic term for the Q12PRHCPU and Q25PRHCPU
Windows Vista®	Generic term for the following: Microsoft® Windows Vista® Home Basic Operating System, Microsoft® Windows Vista® Home Premium Operating System, Microsoft® Windows Vista® Business Operating System, Microsoft® Windows Vista® Ultimate Operating System, Microsoft® Windows Vista® Enterprise Operating System
Windows® XP	Generic term for the following: Microsoft® Windows® XP Professional Operating System, Microsoft® Windows® XP Home Edition Operating System

PACKING LIST

The following are included in the package.

Model	Product name	Quantity
QD64D2	Type QD64D2 4Mpps capable high-speed counter module	1
SW0D5C-QCTU-E	GX Configurator-CT Version 1 (single license product) (CD-ROM)	1
SW0D5C-QCTU-EA	GX Configurator-CT Version 1 (volume license product) (CD-ROM)	1

CHAPTER1   OVERVIEW

This User's Manual describes the specifications, handling, and programming methods for the type QD64D2 4Mpps capable high-speed counter module used together with the MELSEC-Q series CPU module.

The QD64D2 has the following input methods.

- •1 multiple of 1 phase pulse input
- •1 multiple of 2 phases pulse input
- •2 multiples of 1 phase pulse input
- •2 multiples of 2 phases pulse input
- •CW/CCW
- •4 multiples of 2 phases pulse input

For details of the input methods, refer to Section 5.1.

Figure 1.1 shows the general operation of the QD64D2.

1) Pulses to be input to the QD64D2 are counted.
2) Preset value and count value can be latched with external control signal.
3) Status of the I/O signal and buffer memory of the QD64D2 can be checked with the sequence program.
   Also, start/stop of a count, preset, and coincidence output can be performed.
4) When a counter value matches with the set value, an interrupt request can be issued to the programmable controller CPU.
5) The present value is compared with comparison point setting value and the coincidence signal can be output.

Figure 1.1 General operation of the QD64D2

1.1 Features

This section describes the features of the QD64D2.

(1) Counting at the maximum counting speed of 4Mpps is possible. (In 4 multiples of 2 phases)
Since the QD64D2 can be used for high-resolution encoder (e.g. linear scale), the equipment can improve position detection accuracy and a workpiece can be moved at high-speed.

(2) Wide range of expression on counting (from -2147483648 to 2147483647)
Count values can be stored in 32-bit signed binary.

(3) Pulse input selection
Pulse input can be selected from 1 multiple of 1 phase, 2 multiples of 1 phase, 1 multiple of 2 phases, 2 multiples of 2 phases, 4 multiples of 2 phases, and CW/CCW.

(4) Counter format selection
Either of the following counter formats can be selected.

(a) Linear counter format
From -2147483648 to 2147483647 can be counted and an overflow can be detected when the count range is overrun.

(b) Ring counter format
Counts are repeatedly executed between the ring counter upper limit value and ring counter lower limit value.

(5) Coincidence detection
The QD64D2 can compare the present value and comparison point, notify the comparison result with input signal, and start an interrupt program when they match. It also mounts 2-point external coincidence output for each channel, which permits controlling external devices at high-speed.

According to application, select the coincidence output function or continuous comparison function.

(a) Coincidence output function
Set 1 as the coincidence detection point for each point to compare it with the present value.
Reset the coincidence output signal or change the coincidence detection point with the sequence program.
Controlling equipment according to the operating status, such as change of the coincidence detection point according to condition, is possible.

(b) Continuous comparison function

Set from 1 to 16 as the coincidence detection point for each point to compare it with the present value (Only 1 point can be compared simultaneously).

Whenever a coincidence is detected, the coincidence output signal is reset or the coincidence detection point is changed automatically.

If this function is used when the coincidence detection point is predetermined, the sequence program can be reduced, which brings improvement in takt time.

(6) Mounting the coincidence output test function (when using the continuous comparison function)

By using the coincidence output test function, wiring of the coincidence output terminals (EQU1, EQU2) and operations can be checked without count operation.

(7) Preset function

The present value when the preset command (Y04) is input or the preset input terminal (PRST) is turned ON can be overwritten to preset value.

(8) Latch counter function

The present value when the latch counter execution command (Y07) is input or the latch counter input terminal (LATCH) is turned ON can be latched.

(9) Executing the preset function/latch counter function with external control signal

Since the QD64D2 is independent of scan time of the programmable controller CPU, disparity in a span before executing the preset function/latch counter function can be lessen.

(10) Fuse blown at external output part is detectable.

The QD64D2 can detect fuse blown at external output part and notify it with the blown fuse detection flag (X1F) and LED display on it.

(11) Easy setting using GX Configurator-CT

The QD64D2 setting can be performed on screen by using GX Configurator-CT sold separately. Thus, the number of sequence programs results in decreasing and checking a setting status or operation status of modules easily.

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CHAPTER2   SYSTEM CONFIGURATION

This chapter describes system configurations for the QD64D2.

2.1   Applicable Systems

This section describes the applicable systems.

(1) Applicable modules and base units, and No. of modules

(a) When mounted with a CPU module

The table below shows the CPU modules and base units applicable to the QD64D2 and quantities for each CPU model.

Depending on the combination with other modules or the number of mounted modules, power supply capacity may be insufficient.

Pay attention to the power supply capacity before mounting modules, and if the power supply capacity is insufficient, change the combination of the modules.

Table 2.1 Applicable modules and the number of mountable modules

Applicable CPU module		No. of modules[1]	Base unit[2]	
CPU type	CPU model		Main base unit	Extension base unit
Basic model QCPU[3]	Q00JCPU	Up to 8	○	○
	Q00CPU	Up to 24		
	Q01CPU			
High Performance model QCPU	Q02CPU	Up to 64	○	○
	Q02HCPU			
	Q06HCPU			
	Q12HCPU			
	Q25HCPU			
Process CPU	Q02PHCPU	Up to 64	○	○
	Q06PHCPU			
	Q12PHCPU			
	Q25PHCPU			
Redundant CPU[4]	Q12PRHCPU	Up to 53	×	○
	Q25PRHCPU			
Universal model QCPU	Q00UJCPU	Up to 8	○	○
	Q00UCPU	Up to 24		
	Q01UCPU			
	Q02UCPU	Up to 36		
	Q03UDCPU	Up to 64		
	Q04UDHCPU			
	Q06UDHCPU			
	Q10UDHCPU			
	Q13UDHCPU			
	Q20UDHCPU			
	Q26UDHCPU			

(Programmable controller CPU)

2 SYSTEM CONFIGURATION

Table 2.1 Applicable modules and the number of mountable modules (Continued)

Applicable CPU module		CPU model	No. of modules[1]	Base unit[2]	
CPU type				Main base unit	Extension base unit
Programmable controller CPU	Universal model QCPU	Q03UDECPU	Up to 64	○	○
		Q04UDEHCPU			
		Q06UDEHCPU			
		Q10UDEHCPU			
		Q13UDEHCPU			
		Q20UDEHCPU			
		Q26UDEHCPU			
		Q50UDEHCPU			
		Q100UDEHCPU			
	Safety CPU	QS001CPU	N/A	×	×[5]
C Controller module		Q06CCPU-V	Up to 64	○	○
		Q06CCPU-V-B			
		Q12DCCPU-V			

○: Applicable ×: N/A

* 1 Limited within the range of I/O points for the CPU module.
* 2 Can be installed to any I/O slot of a base unit.
* 3 For the coincidence detection interrupt function, use the Basic model QCPU of function version B or later.
* 4 The coincidence detection interrupt function is not supported.
* 5 Connection of extension base units is not available with any safety CPU.

Remark •

For the use of the C Controller module, refer to C Controller Module User's Manual.

• •

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(b) Mounting to a MELSECNET/H remote I/O station

The following table shows network modules that can be mounted to the QD64D2, the number of mountable network modules, and applicable base units.

The QD64D2 module can be mounted into any I/O slots[1] on the applicable base unit.

However, the power capacity may be insufficient depending on the combination with the other mounted modules and the number of mounted modules.

Be sure to check the power capacity when mounting the modules.

Table 2.2 Mountable network modules, No. of mountable modules, and mountable base unit

Mountable network module[3]	Number of mountable modules[1]	Applicable base unit[2]	
		Main base unit on the remote I/O station	Extension base unit on the remote I/O station
QJ72LP25-25	Up to 64	○	○
QJ72LP25G			
QJ72LP25GE			
QJ72BR15			

○: Applicable × : N/A

* 1 Limited within the range of I/O points for the network module.
* 2 Can be installed to any I/O slot of a base unit.
* 3 The coincidence detection interrupt function is not supported.

Remark •

The Basic model QCPU or C Controller module cannot create the MELSECNET/H remote I/O network.

• •

(2) Support of the multiple CPU system

The QD64D2 of first released version to function version B supports multiple CPU system.

When using the QD64D2 in a multiple CPU system, refer to the following manual first.

☞ QCPU User's Manual (Multiple CPU System)

(a) Intelligent function module parameters

Write intelligent function module parameters to only the control CPU of the QD64D2.

(3) Supported software packages

Relation between the system using the QD64D2 and software package is shown in the following table.

GX Developer is necessary when using the QD64D2.

Table 2.3 Software package version

Item		Software version		
		GX Developer	GX Configurator-CT	GX Works2
Q00J/Q00/Q01CPU	Single CPU system	Version 7 or later		Version 1.10N or later
	Multiple CPU system	Version 8 or later		
Q02/Q02H/Q06H/ Q12H/Q25HCPU	Single CPU system	Version 4 or later		Version 1.08J or later
	Multiple CPU system	Version 6 or later		
Q02H/Q06HCPU	Single CPU system	Version 8.68W or later		Use prohibited
	Multiple CPU system			
Q12PH/Q25PHCPU	Single CPU system	Version 7.10L or later		
	Multiple CPU system			
Q12PRH/ Q25PRHCPU	Redundant system	Version 8.45X or later		
Q00UJ/Q00U/ Q01UCPU	Single CPU system	Version 8.76E or later	Version 1.28AE or later	Version 1.08J or later
	Multiple CPU system			
Q02U/Q03UD/ Q04UDH/ Q06UDHCPU	Single CPU system	Version 8.48A or later		
	Multiple CPU system			
Q10UDH/ Q20UDHCPU	Single CPU system	Version 8.76E or later		
	Multiple CPU system			
Q13UDH/ Q26UDHCPU	Single CPU system	Version 8.62Q or later		
	Multiple CPU system			
Q03UDE/Q04UDEH/ Q06UDEH/Q13UDEH/ Q26UDEHCPU	Single CPU system	Version 8.68W or later		
	Multiple CPU system			
Q10UDEH/ Q20UDEHCPU	Single CPU system	Version 8.76E or later		
	Multiple CPU system			
Q50UDEH/ Q100UDEHCPU	Single CPU system	Use prohibited	Use prohibited	Version 1.31H or later
	Multiple CPU system			
When mounted to the MELSECNET/H remote I/O station		Version 6 or later	Version 1.28AE or later	Use prohibited

(4) Connector

The connector is not included with the QD64D2.

Purchase it with reference to Section 4.3.

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2.2 About Use of the QD64D2 with Redundant CPU

This section explains how to use the QD64D2 with the Redundant CPU.

(1) GX Configurator-CT

GX Configurator-CT cannot be used when accessing the Redundant CPU via an intelligent function module on an extension base unit from GX Developer.
Connect a personal computer with a communication path indicated below.
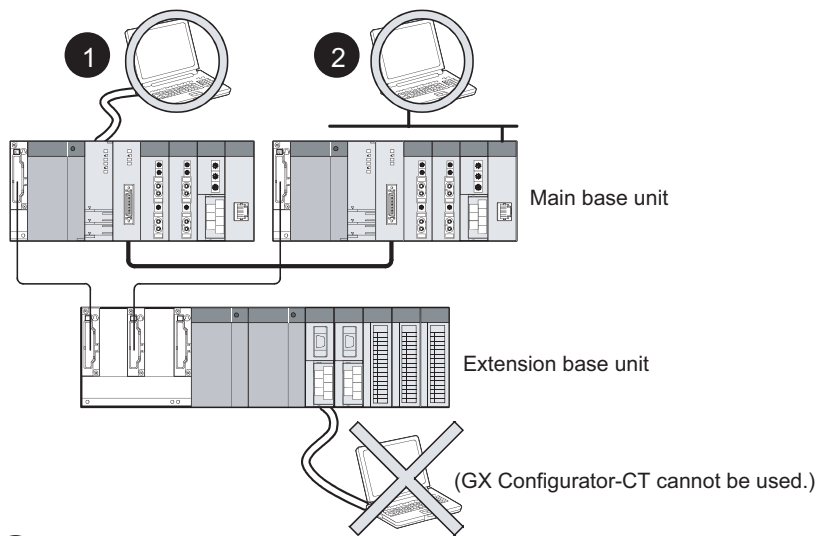
1 Connecting directly to a programmable controller CPU

2 Connecting to a programmable controller CPU via an intelligent function module (Ethernet module, MELSECNET/H module, or CC-Link module) on the main base unit

Figure 2.1 Communication path which GX Configrator-CT can use

(2) Restrictions when using the Redundant CPUs

The coincidence detection interrupt function is not available.

2.3 About Use of the QD64D2 on the MELSECNET/H Remote I/O Station

This section explains how to use the QD64D2 on the MELSECNET/H remote I/O station.

(1) Number of QD64D2 that can be installed when the remote I/O station is used

Refer to Section 2.1 concerning the number of the QD64D2 that can be installed when the remote I/O station is used.

(2) Limitations when using the remote I/O station

(a) The coincidence detection interrupt function cannot be used.

(b) When the QD64D2 is used on the MELSECNET/H remote I/O station, a delay will occur due to the link scan time. Therefore, fully verify that there will be no problem with controllability in the target system.

(Example) When processing is executed using the counter value input by a sequence program, variations will occur due to a delay in the link scan time.

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2.4   How to Check the Function Version/Serial No./Software Version

(1) Checking the rating plate on the module side

The rating plate is situated on the side face of the QD64D2.
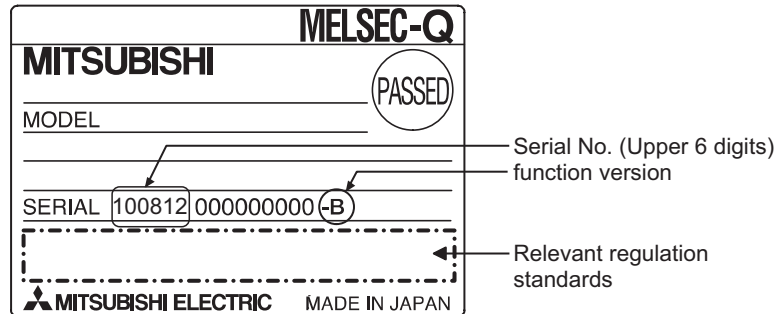
Figure 2.2 Checking the serial No. and function version (rating plate)

(2) Checking on the front of the module

The serial No. on the rating plate is also indicated on the front of the module (lower part).
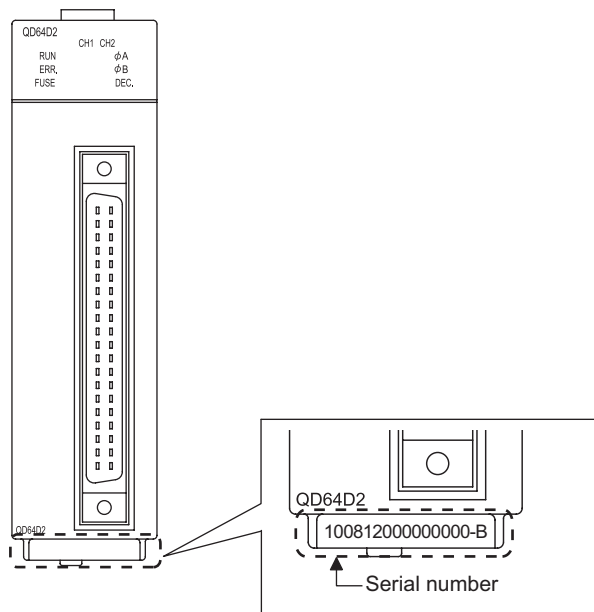
Figure 2.3 Display on the front of the module

Remark •

The serial number is displayed on the front of the module from August 2008 production. Products manufactured during switching period may not have the serial number on the front of the module.

• •

(3) Confirming the serial number on the system monitor (Product Information List)

To display the screen for checking the serial number and function version, select [Diagnostics] → [System monitor] and click the ⎢Product Inf. List⎥ button in GX Developer.

Serial number   Function version

Slot	Type	Series	Model name	Points	I/O No.	Master PLC	Serial No	Ver.
PLC	PLC	Q	Q25PHCPU	-	-	-	061020000000000	C
0-0	Intelli.	Q	QD64D2	32pt	0000	-	091010000000000	B
0-1	-	-	None	-	-	-	-	-
0-2	-	-	None	-	-	-	-	-
0-3	-	-	None	-	-	-	-	-
0-4	-	-	None	-	-	-	-	-

Figure 2.4 System monitor

(a) Production number display
Since the QD64D2 does not support the production number display, "-" is displayed.

⊠POINT

The serial No. displayed in the Product Information List of GX Developer may be different from the one on the rating plate and the front of the module.
- The serial No. on the rating plate and the front of the module indicates the management information of the product.
- The serial No. in the Product Information List of GX Developer indicates the functional information on the product, which is updated when a new function is added.

(4) Checking the software version of GX Configurator-CT

The software version of GX Configurator-CT can be checked GX Developer's "Product information" screen.

[Operating procedure]

GX Developer → [Help] → [Product information]
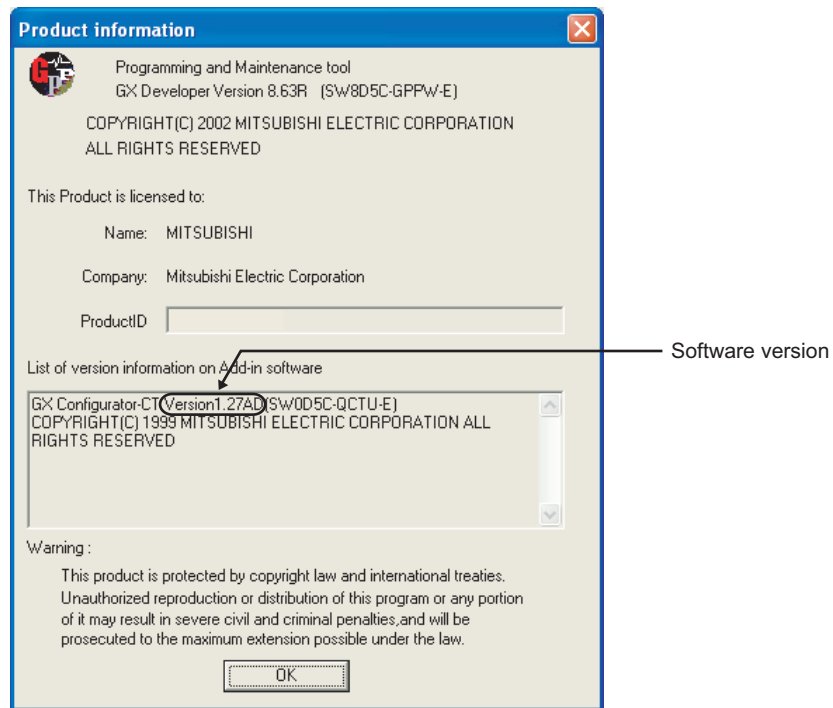
(In the case of GX Developer Version 8)

Figure 2.5 [Product information] screen of GX Developer

CHAPTER3   SPECIFICATIONS

This chapter describes the performance specifications of the QD64D2, I/O signals to the programmable controller CPU, specifications of the buffer memory.
For general specifications of the QD64D2, refer to the User's Manual for the CPU module.

3.1   Performance Specifications

The following table shows the performance specifications of the QD64D2.

Table 3.1 Performance specifications of the QD64D2

Item		Specifications
Number of channels		2 channels
Count input signal	Phase	1-phase input, 2-phase input
	Signal level (ϕA, ϕB)	EIA Standard RS-422-A Differential line driver level (AM26LS31 (manufactured by Texas Instruments Incorporated) or equivalent)
Counter	Counting speed (max.) *1 *2	4 multiples of 2 phases : 4Mpps 2 multiples of 1 phase, 2 multiples of 2 phases: 2Mpps 1 multiple of 1 phase, 1 multiple of 2 phases, CW/CCW: 1Mpps
	Counting range	32-bit signed binary (-2147483648 to 2147483647)
	Type	Addition method, subtraction method linear counter format, ring counter format preset counter function, latch counter function
	Minimum count pulse width (Duty ratio 50 %)	 (Minimum phase difference for 2-phase input: 0.25 μs) For details, refer to Section 3.1.1
Coincidence detection	Comparison range	32-bit signed binary
	Comparison result	Setting value < Count value Setting value = Count value Setting value > Count value
	Interrupt	With coincidence detection interrupt function
External input	Preset	24VDC 2 to 5mA
	Count value latch	
External output	Coincidence output	Transistor (sinking type) output: 2 points/channel 12/24VDC 0.5 A/point 2 A/common
	Derating	Applied (refer to Section 3.1.2)
Number of occupied I/O points		32 points (I/O assignment: Intelligent 32 points)
5VDC internal current consumption		0.53 A
Weight		0.16 kg

* 1 Note that counting a pulse whose phase difference between phase A and phase B is small may result in a count error.
For the relation of phase difference between phase A and phase B, refer to Section 3.3.1.

* 2 The maximum counting speed is determined in the pulse input mode.
Counting speed cannot be changed.

3.1.1   Relation of phase difference between phase A and phase B

The relation indicated below is for each pulse input mode at the maximum counting speed. Pulse input waveform that does not reach to the maximum counting speed is also applicable.

(a) At 1-phase input

Pulse input waveform at 1-phase input input needs to satisfy the following conditions (duty ratio of 50%).

$t\ (=t_H+t_L) = 1.0\ \mu s$

$t_H,\ t_L = 0.5\ \mu s\ (= 0.5 \times t)$
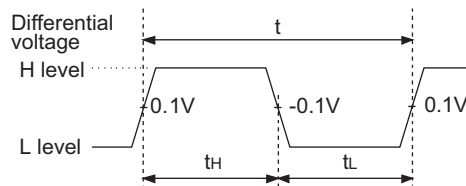
Figure 3.1 Pulse input waveform at 1-phase input

(b) At 2-phase input

Pulse input waveform at 2-phase input needs to satisfy both the condition at 1-phase input and the condition below.

$t_1,\ t_2,\ t_3,\ t_4 = 0.25\ \mu s\ (= 0.25 \times t)$
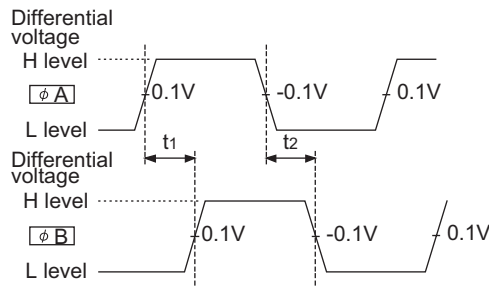
Figure 3.2 Pulse input waveform at 2-phase input 1
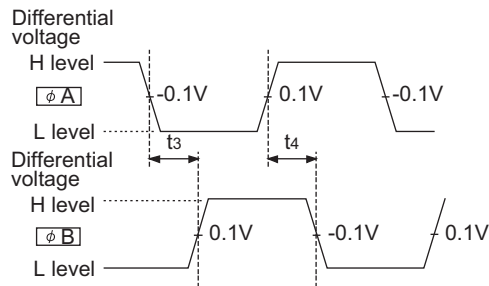
Figure 3.3 Pulse input waveform at 2-phase input 2

3.1.2 Derating chart
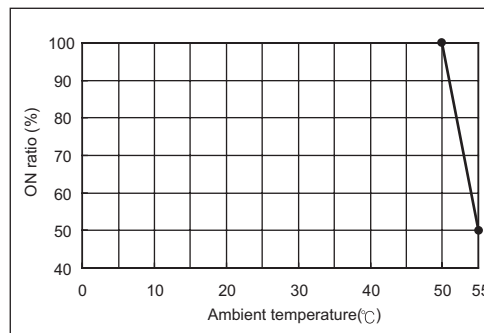
Figure 3.4 Derating chart

This section explains conditions for each counter value comparison function selection.

(1) When all channels are the coincidence output function

Take care so that the ratio of the number of points that external coincidence output (ON) is executed to the number of external coincidence output points of the module (4 points) does not exceed the ON ratio in Figure 3.4.

$$\text{ON ratio [\%]} \geqq \frac{\text{The number of points that external coincidence output (ON) is executed}}{4 \text{ (point)}} \times 100 \text{ [\%]}$$

(2) When all channels are the continuous comparison function

Take care so that the ratio of continuous comparison No. m ON time setting (Un\G52, Un\G102) (t1) to the time from start of coincidence output to the next coincidence output (t2) in Figure 3.5 may not exceed the ON ratio in Figure 3.4.
(For interval of the continuous comparison No. m point n setting that decides t2, refer to Section 5.3.2.)

$$\text{ON ratio [\%]} \geqq \frac{t1[\text{ms}]}{t2[\text{ms}]} \times 100 \text{ [\%]}$$
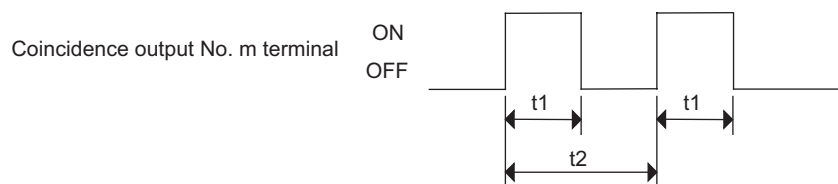
Figure 3.5 Relationship between ON time setting in the case of the continuous comparison function (t1) and the time from start of coincidence output to the next coincidence output (t2)

3 - 4

(3) When (CH1 or CH2) is the coincidence output function and (CH2 or CH1) is the continuous comparison function

Take care so that the addition of the ratio of above (1) "When all channels are the coincidence output function" in the CH where the coincidence output function is set and a value when the ratio of above (2) "When all channels are the continuous comparison function" in the CH where the continuous comparison function is set is divided by 2 may not exceed the ON ratio in Figure 3.4

$$\text{ON ratio [\%]} \geqq \text{Ratio of above (1) "When all channels are the coincidence output function" [\%]} + \frac{\text{Ratio of above (2) "When all channels are the continuous comparison function" [\%]}}{2}$$

$$\geqq \left(\frac{\text{The number of points that external coincidence output (ON) is executed}}{4 \text{ (point)}} \times 100 \right)[\%] + \frac{\left(\dfrac{t1[\text{ms}]}{t2[\text{ms}]} \times 100 \right)[\%]}{2}$$

3.2 Function List

The following table shows the functions of the QD64D2.
I/O numbers (X/Y) and buffer memory addresses in Description describe only for channel 1.
For I/O numbers (X/Y) of channel 2 and buffer memory addresses, refer to Section 3.3.1.

Table 3.2 Function list of the QD64D2

Function [1]			Description	Reference
Linear counter function			Counts within the range from -2147483648 to 2147483647. An overflow occurs when a count exceeds the count range.	Section 5.2.1
Ring counter function			Repeats a count between the ring counter upper limit value and the lower limit value.	Section 5.2.2
Counter value comparison function	Coincidence output function		Compares preset coincidence detection point of an arbitrary channel with the present counter value and outputs the counter value coincidence.	Section 5.3.1
	Continuous comparison function		Compares any of preset coincidence detection points of an arbitrary channel with the present counter value and outputs the counter value coincidence during the set time after the coincidence.	Section 5.3.2
		Coincidence output test function	Checks wiring of coincidence output. This function can be used only when the continuous comparison function is selected.	Section 5.3.3
	Coincidence detection interrupt function		Generates an interrupt signal to the programmable controller CPU when a coincidence is detected, and starts an interrupt program.	Section 5.3.4
Preset function			Overwrites present value to an arbitrary value.	Section 5.4
Latch counter function			Latches the present value.	Section 5.5

* 1 The functions can be used in combination.
      However, as for the following functions, select either of them.
      • Linear counter function, ring counter function
      • Coincidence output function, continuous comparison function

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3.3 I/O Signals to the Programmable Controller CPU

3.3.1 List of I/O signals

The following table shows the I/O signals from the QD64D2 to the programmable controller CPU.
Note that I/O numbers (X/Y) mentioned in this and the subsequent chapters are assumed when the QD64D2 is mounted to the null I/O slot on the main base unit.

(1) List of input signals (Signal direction: QD64D2 → Programmable controller CPU)

Table 3.3 List of input signals

I/O number		Signal name	I/O number		Signal name
X00		Module READY	X10		Reserved
X01	CH1	Counter value large No.1	X11	CH2	Counter value large No.1
X02		Counter value coincidence No.1	X12		Counter value coincidence No.1
X03		Counter value small No.1	X13		Counter value small No.1
X04		Counter value large No.2	X14		Counter value large No.2
X05		Counter value coincidence No.2	X15		Counter value coincidence No.2
X06		Counter value small No.2	X16		Counter value small No.2
X07		Reserved	X17		Reserved
X08		External preset request detection	X18		External preset request detection
X09		During continuous comparison No.1 execution [1]	X19		During continuous comparison No.1 execution [1]
X0A		During continuous comparison No.2 execution [1]	X1A		During continuous comparison No.2 execution [1]
X0B		Reserved	X1B		Reserved
X0C		Reserved	X1C		Reserved
X0D		Error occurrence	X1D		Error occurrence
X0E		Warning occurrence	X1E		Warning occurrence
X0F		Reserved	X1F		Blown fuse detection flag

* 1 The signals are used only for the continuous comparison function.

⊠**POINT**

The reserved signals above are for system use, not for users. If used (turning ON/OFF) by a user, the functions of the QD64D2 are not guaranteed.

(2) List of output signals (Signal direction: Programmable controller CPU → QD64D2)

Table 3.4 List of output signals

I/O number	Signal name		Operation timing	I/O number	Signal name		Operation timing
Y00	Reserved		---	Y10	Reserved		---
Y01		Coincidence signal No.1 reset command [*1]	⎍	Y11		Coincidence signal No.1 reset command [*1]	⎍
Y02		Coincidence signal No.2 reset command [*1]		Y12		Coincidence signal No.2 reset command [*1]	
Y03		Coincidence output enable command [*1]	⎍	Y13		Coincidence output enable command [*1]	⎍
Y04		Preset command	⤒	Y14		Preset command	⤒
Y05		Subtraction count command	⎍	Y15		Subtraction count command	⎍
Y06		Count enable command	⎍	Y16		Count enable command	⎍
Y07	CH1	Latch counter execution command	⤒	Y17	CH2	Latch counter execution command	⤒
Y08		External preset request detection reset command	⤒	Y18		External preset request detection reset command	⤒
Y09		Continuous comparison No.1 execution command [*2]	⎍	Y19		Continuous comparison No.1 execution command [*2]	⎍
Y0A		Continuous comparison No.2 execution command [*2]		Y1A		Continuous comparison No.2 execution command [*2]	
Y0B		Coincidence output No.1 test command [*2]	⎍	Y1B		Coincidence output No.1 test command [*2]	⎍
Y0C		Coincidence output No.2 test command [*2]		Y1C		Coincidence output No.2 test command [*2]	
Y0D		Error reset command	⤒	Y1D		Error reset command	⤒
Y0E	Reserved		---	Y1E	Reserved		---
Y0F				Y1F			

* 1 The signal is only used for the coincidence output function.
* 2 The signal is only used for the continuous comparison function.

⊠**POINT**

(1) The reserved signals above are for system use, not for users. If used (turning ON/OFF) by a user, the functions of the QD64D2 are not guaranteed.

(2) Definitions of the expression in Operation timing are as follows.

- ⎍ :Enabled while the signal is ON.
  ON time should be 2ms or longer.

- ⤒ :Enabled when the signal is turned from OFF to ON.
  ON time and OFF time should be 2ms or longer.

3.3.2   Functions of I/O signals

The following indicates the details of I/O signals of the QD64D2.

In this section, I/O numbers (X/Y) and buffer memory addresses are listed only for channel 1.
For I/O numbers and buffer memory addresses used for channel 2, refer to Section 3.3.1 and Section 3.4.1.

(1) Module READY(X00)

- Turns ON at reset or power-on of the programmable controller CPU when the QD64D2 is ready for counting, and the counting process is executed.

- Turns OFF when a watchdog timer error or an error which affects the system (Error code: 810 to 860) occurs.

- When the module READY (X00) is OFF, the counting is not executed.

- Use this signal for an interlock of a sequence program.

Figure 3.6 Operation of the module READY (X00)

(2) Counter value large No.1 (X01), counter value coincidence No.1 (X02), counter value small No.1 (X03)
counter value large No.2 (X04), counter value coincidence No.2 (X05), counter value small No.2 (X06)

The signals notify a comparison result in the counter value comparison function (coincidence output function, continuous comparison function).

In (a) and (b) below, operations of the counter value large No.1 (X01), the counter value coincidence No.1 (X02) and the counter value small No.1 (X03) are explained. For the counter value large No.2 (X04), the counter value coincidence No.2 (X05), and the counter value small No.2 (X06), operations are the same except that I/O numbers (X/Y) and buffer memory addresses of the point used for comparison are different.

(a) Operation when used for the coincidence output function (Refer to Section 5.3.1.)

		Counter value large No.1(X01)	Counter value coincidence No.1(X02)	Counter value small No.1(X03)
Present value (Un\G12 and 13)	<	Coincidence output No.1 point setting (Un\G6 and 7)	OFF	OFF	ON
Present value (Un\G12 and 13)	=	Coincidence output No.1 point setting (Un\G6 and 7)	OFF	ON*	OFF
Present value (Un\G12 and 13)	>	Coincidence output No.1 point setting (Un\G6 and 7)	ON	OFF	OFF

* The counter value coincidence No.1 (X02) remains ON until the coincidence signal No.1 reset command (Y01) is turned ON.
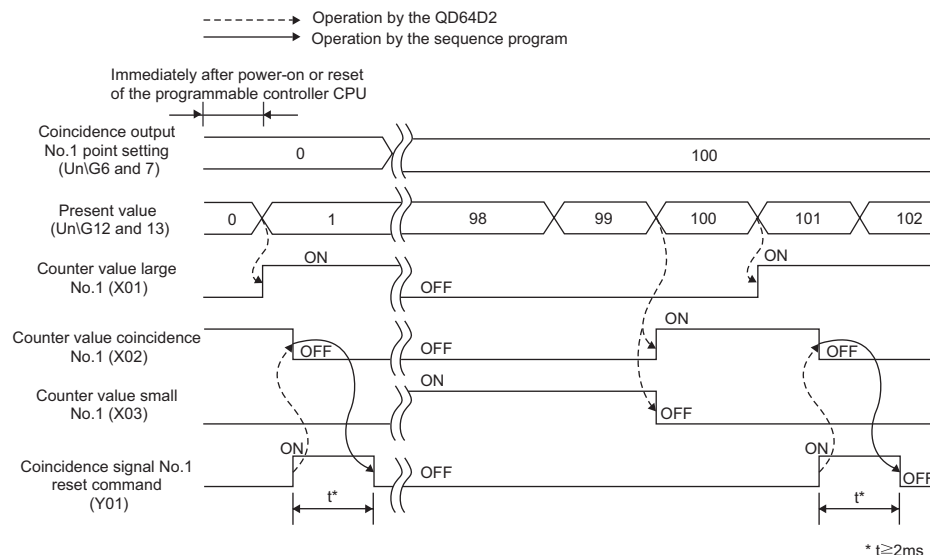
Figure 3.7 Operation of the counter value large No.1 (X01), the counter value coincidence No.1 (X02) and the counter value small No.1 (X03) when using the coincidence output function

(b) Operation when used for the continuous comparison function (Refer to Section 5.3.2.)

		Counter value large No.1(X01)	Counter value coincidence No.1(X02)	Counter value small No.1(X03)
Present value (Un\G12 and 13)	<	Continuous comparison No.1 point n setting (Un\G54 to 85)	OFF	OFF	ON
Present value (Un\G12 and 13)	=	Continuous comparison No.1 point n setting (Un\G54 to 85)	OFF	ON*	OFF
Present value (Un\G12 and 13)	>	Continuous comparison No.1 point n setting (Un\G54 to 85)	ON	OFF	OFF

* The counter value coincidence No.1 (X02) remains ON for the preset time of the continuous comparison No.1 ON time setting (Un\G52).

Usage condition of the following operation diagram
Continuous comparison No.1 start point setting (Un\G50): 1 (point 1)
Continuous comparison No.1 repeat point setting (Un\G51): 3 (point 3)
Continuous comparison No.1 point 1 setting (Un\G54 and 55): 100
Continuous comparison No.1 point 2 setting (Un\G56 and 57): 10000
Continuous comparison No.1 point 3 setting (Un\G58 and 59): 20000

------→ Operation by the QD64D2
————→ Operation by the sequence program

*1 t1 = Continuous comparison No.1 ON time setting (Un\G52)
*2 t1 < t2 < (t1+1ms)

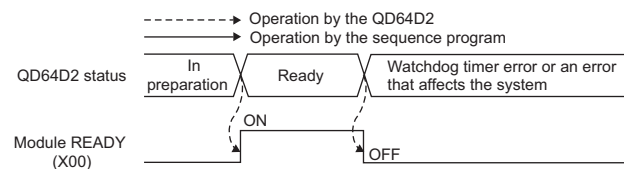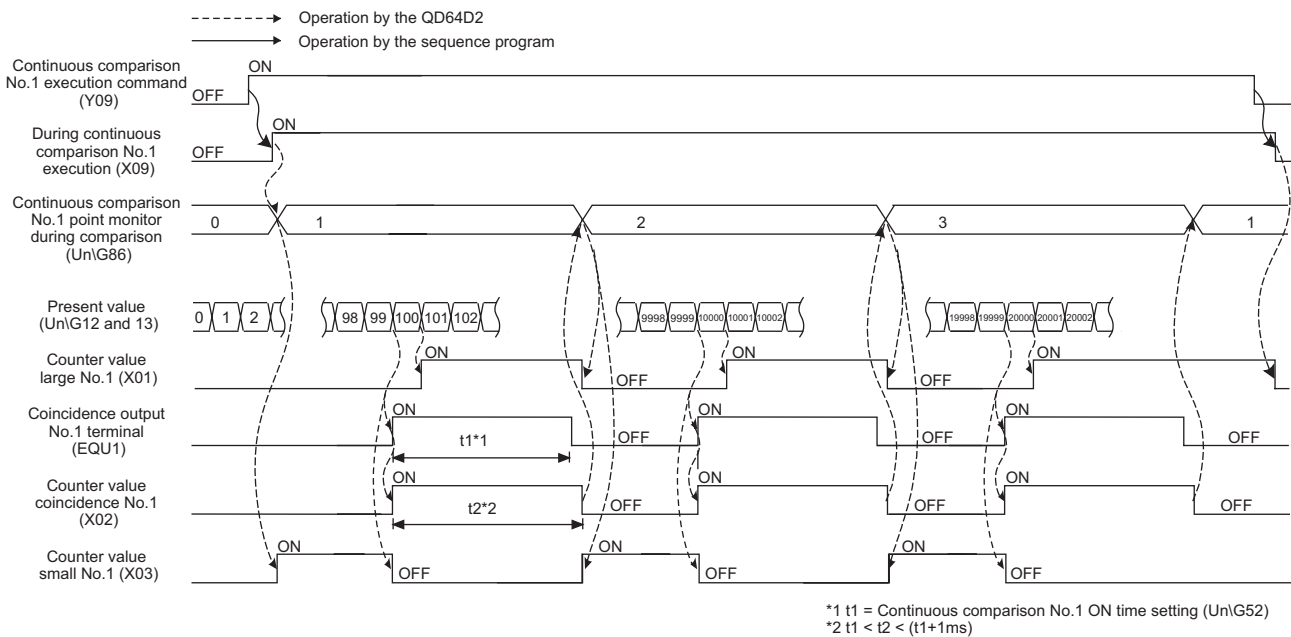**Figure 3.8 Operation of the counter value large No.1 (X01), the counter value coincidence No.1 (X02) and the counter value small No.1 (X03) when using the continuous comparison function**

(3) External preset request detection (X08)

- Turns ON when the preset input terminal (PRST) is turned ON.
- To turn OFF the external preset request detection (X08), turn ON the external preset request detection reset command (Y08).
- The preset cannot be executed while the external preset request detection (X08) is ON.
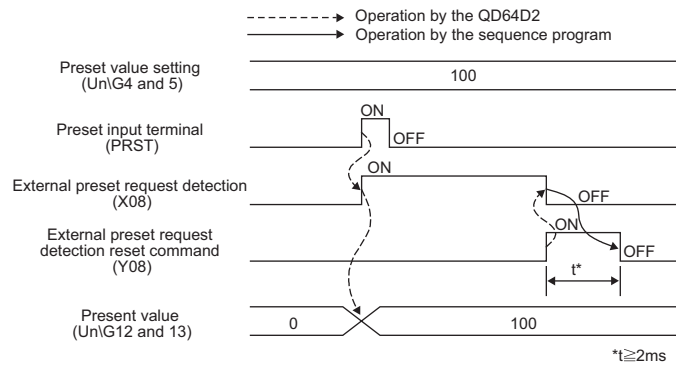
Figure 3.9 Operation of the external preset request detection (X08)

(4) During continuous comparison No.1 execution (X09), during continuous comparison No.2 execution (X0A)

- Turns ON during execution of the continuous comparison function. (Refer to Section 5.3.2.)

(5) Error occurrence (X0D)

- Turns ON when an error occurs.
- To turn OFF the error occurrence (X0D), fix the cause of the error and then turn ON the error reset command (Y0D).
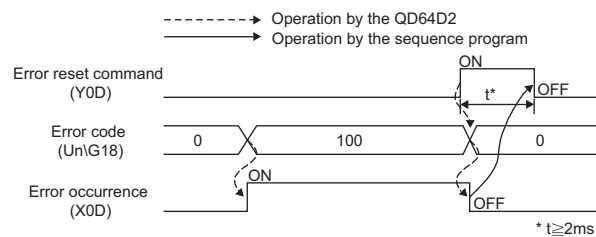
Figure 3.10 Operation of the error occurrence (X0D)

(6) Warning occurrence (X0E)

- Turns ON when a warning occurs.
- To turn OFF the warning occurrence (X0E), fix the cause of the warning and then turn ON the error reset command (Y0D).
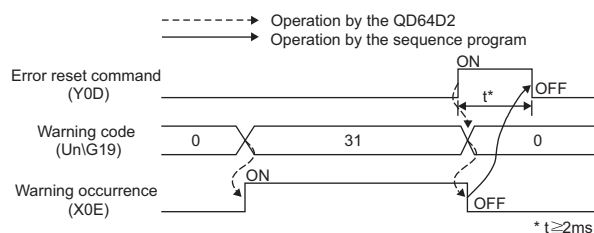
Figure 3.11 Operation of the warning occurrence (X0E)

(7) Blown fuse detection flag (X1F)

- Turns ON when a fuse blown of the external coincidence output part is detected.

- Even if the fuse is blown, the signal does not turn ON unless a voltage is applied to the external coincidence output power supply terminal.

- For actions when a fuse is blown, refer to Section 8.1.4.
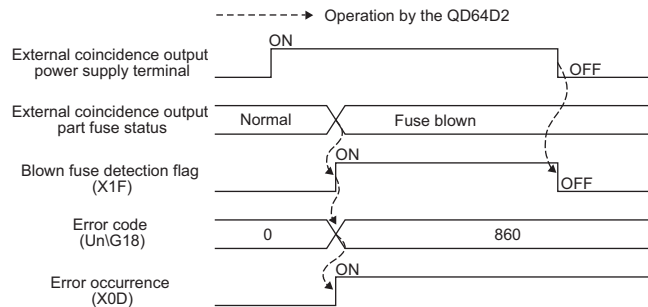
Figure 3.12 Operation of the blown fuse detection flag (X1F)

(8) Coincidence signal No.1 reset command (Y01), coincidence signal No.2 reset command (Y02)

- Use the signals for the coincidence output function. (Refer to Section 5.3.1.)

- Turn ON the coincidence signal No.1 reset command (Y01) to reset the counter value coincidence No.1 (X02).

- Turn ON the coincidence signal No.2 reset command (Y02) to reset the counter value coincidence No.2 (X05).

- Turn OFF the signal after the resetting is completed.

(9) Coincidence output enable command (Y03)

- Use the signal for the coincidence output function. (Refer to Section 5.3.1.)

- Turn ON the coincidence output enable command (Y03) to enable output from the coincidence output No.1 terminal (EQU1) and the coincidence output No.2 terminal (EQU2) of the external device connector when the count value coincides with the comparison point.
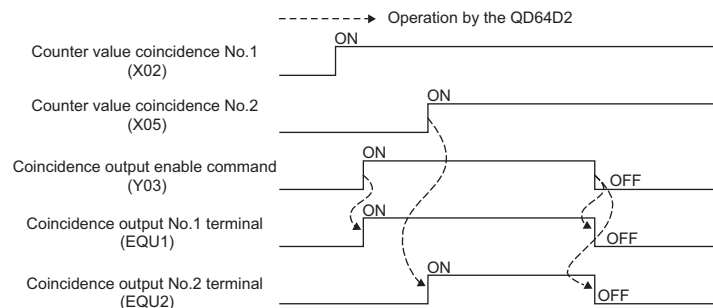
Figure 3.13 Operation of the coincidence output enable command (Y03)

(10)Preset command (Y04)

- Turn ON the preset command (Y04) to execute the preset function (Refer to Section 5.4).

- Check that the present value (Un\G12 and 13) has been changed, then turn OFF the preset command (Y04).

- While the external preset request detection (X08) is ON, the preset cannot be executed by the preset command (Y04).
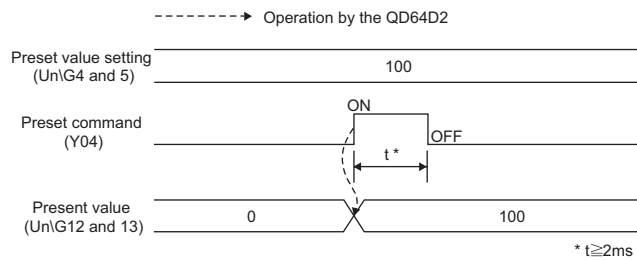
Figure 3.14 Operation of the preset command (Y04)

(11)Subtraction count command (Y05)

- Turn ON to execute the subtraction count at 1-phase input mode.

- In the 1-phase pulse input mode, the subtraction count is executed when the phase B pulse or the subtraction count command (Y05) is turned ON.

- When the pulse input mode is 1 multiple of 1 phase, counting is executed as shown below.

- For the addition count, check that the phase B pulse and the subtraction count command (Y05) are turned OFF.
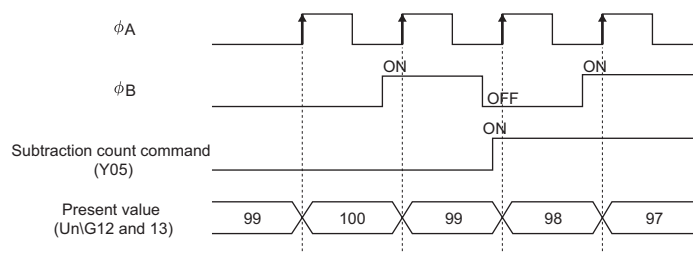
Figure 3.15 Operation of the subtraction count command (Y05) (when the pulse input mode is 1 multiple of 1 phase)

(12)Count enable command (Y06)

- Turn ON the count enable command (Y06) to start the count operation.

- When the pulse input mode is 1 multiple of 1 phase, counting is executed as shown below.
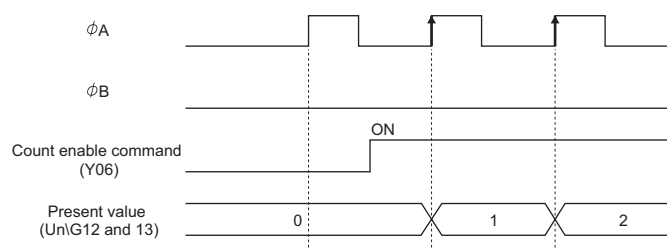
Figure 3.16 Operation of the count enable command (Y06) (when the pulse input mode is 1 multiple of 1 phase)

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(13)Latch counter execution command (Y07)

- When the latch counter execution command (Y07) is turned from OFF to ON, the present value (Un\G12 and 13) is stored in the latch count value (Un\G14 and 15).

- Turn OFF the latch counter execution command (Y07) after the present value (Un\G12 and 13) is stored in the latch count value (Un\G14 and 15).
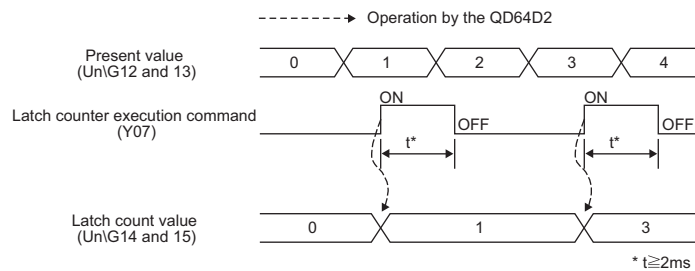
Figure 3.17 Operation of the latch counter execution command (Y07)

(14)External preset request detection reset command (Y08)

- Turn ON to turn OFF the external preset request detection (X08).

(15)Continuous comparison No.1 execution command (Y09), continuous comparison No.2 execution command (Y0A)

- Turn ON to execute the continuous comparison function. (Refer to Section 5.3.2.)

(16)Coincidence output No.1 test command (Y0B), coincidence output No.2 test command (Y0C)

- Turn ON to execute the coincidence output test function. (Refer to Section 5.3.3.)

(17)Error reset command (Y0D)

- Turn ON to reset the error and warning.

- After fixing the cause of the error, reset the error code so that the newly detected errors can be checked.

3.4 Buffer Memory Assignment

3.4.1 List of buffer memory assignment

The following table shows the buffer memory assignment of the QD64D2. For details of each buffer memory, refer to Section 3.4.2.

Table 3.5 List of buffer memory assignment

Address (decimal notation) CH1	CH2	Setting contents		Initial value [1]	Read/write	Remarks
0	200	Ring counter lower limit value [2]	(L)			Only used for the ring counter function.
1	201		(H)			
2	202	Ring counter upper limit value [2]	(L)			
3	203		(H)			
4	204	Preset value setting [2]	(L)		Read/write are enabled.	----
5	205		(H)			
6	206	Coincidence output No.1 point setting [2]	(L)			Only used for the coincidence output function.
7	207		(H)			
8	208	Coincidence output No.2 point setting [2]	(L)	0		
9	209		(H)			
10	210	Coincidence output No.1 point change request				
11	211	Coincidence output No.2 point change request				
12	212	Present value [2]	(L)			----
13	213		(H)			
14	214	Latch count value [2]	(L)		Read only	
15	215		(H)			
16	216	Overflow detection flag				Only used for the linear counter function.
17	217	External I/O status monitor				----
18	218	Error code				
19	219	Warning code				
20 to 49	220 to 249	Reserved		----	----	----
50	250	Continuous comparison No.1 start point setting			Read/write are enabled.	Only used for the continuous comparison function.
51	251	Continuous comparison No.1 repeat point setting		0		
52	252	Continuous comparison No.1 ON time setting				
53	253	Reserved		----	----	----
54	254	Continuous comparison No.1 point 1 setting [2]	(L)		Read/write are enabled.	Only used for the continuous comparison function.
55	255		(H)			
56	256	Continuous comparison No.1 point 2 setting [2]	(L)	0		
57	257		(H)			
58	258	Continuous comparison No.1 point 3 setting [2]	(L)			
59	259		(H)			

* 1 Initial value which is set when the module is powered on or the programmable controller CPU is reset.
* 2 Read and write a value in 32-bit signed binary format. (Make sure to use a value in units of 2 words.)

Table 3.5 List of buffer memory assignment (Continued)

Address (decimal notation) CH1	CH2	Setting contents		Initial value *1	Read/write	Remarks
60	260	Continuous comparison No.1 point 4	(L)			
61	261	setting *2	(H)			
62	262	Continuous comparison No.1 point 5	(L)			
63	263	setting *2	(H)			
64	264	Continuous comparison No.1 point 6	(L)			
65	265	setting *2	(H)			
66	266	Continuous comparison No.1 point 7	(L)			
67	267	setting *2	(H)			
68	268	Continuous comparison No.1 point 8	(L)			
69	269	setting *2	(H)			
70	270	Continuous comparison No.1 point 9	(L)			
71	271	setting *2	(H)			
72	272	Continuous comparison No.1 point 10	(L)	0	Read/write are enabled.	Only used for the continuous comparison function.
73	273	setting *2	(H)			
74	274	Continuous comparison No.1 point 11	(L)			
75	275	setting *2	(H)			
76	276	Continuous comparison No.1 point 12	(L)			
77	277	setting *2	(H)			
78	278	Continuous comparison No.1 point 13	(L)			
79	279	setting *2	(H)			
80	280	Continuous comparison No.1 point 14	(L)			
81	281	setting *2	(H)			
82	282	Continuous comparison No.1 point 15	(L)			
83	283	setting *2	(H)			
84	284	Continuous comparison No.1 point 16	(L)			
85	285	setting *2	(H)			
86	286	Continuous comparison No.1 point monitor during comparison			Read only	
87 to 99	287 to 299	Reserved		----	----	----
100	300	Continuous comparison No.2 start point setting			Read/write are enabled.	Only used for the continuous comparison function.
101	301	Continuous comparison No.2 repeat point setting		0		
102	302	Continuous comparison No.2 ON time setting				
103	303	Reserved		----	----	----
104	304	Continuous comparison No.2 point 1	(L)		Read/write are enabled.	Only used for the continuous comparison function.
105	305	setting *2	(H)	0		
106	306	Continuous comparison No.2 point 2	(L)			
107	307	setting *2	(H)			

* 1 Initial value which is set when the module is powered on or the programmable controller CPU is reset.
* 2 Read and write a value in 32-bit signed binary format. (Make sure to use a value in units of 2 words.)

Table 3.5 List of buffer memory assignment (Continued)

Address (decimal notation)		Setting contents		Initial value *1	Read/write	Remarks
CH1	CH2					
108	308	Continuous comparison No.2 point 3 setting *2	(L)	0	Read/write are enabled.	Only used for the continuous comparison function.
109	309		(H)			
110	310	Continuous comparison No.2 point 4 setting *2	(L)			
111	311		(H)			
112	312	Continuous comparison No.2 point 5 setting *2	(L)			
113	313		(H)			
114	314	Continuous comparison No.2 point 6 setting *2	(L)			
115	315		(H)			
116	316	Continuous comparison No.2 point 7 setting *2	(L)			
117	317		(H)			
118	318	Continuous comparison No.2 point 8 setting *2	(L)			
119	319		(H)			
120	320	Continuous comparison No.2 point 9 setting *2	(L)			
121	321		(H)			
122	322	Continuous comparison No.2 point 10 setting *2	(L)			
123	323		(H)			
124	324	Continuous comparison No.2 point 11 setting *2	(L)			
125	325		(H)			
126	326	Continuous comparison No.2 point 12 setting *2	(L)			
127	327		(H)			
128	328	Continuous comparison No.2 point 13 setting *2	(L)			
129	329		(H)			
130	330	Continuous comparison No.2 point 14 setting *2	(L)			
131	331		(H)			
132	332	Continuous comparison No.2 point 15 setting *2	(L)			
133	333		(H)			
134	334	Continuous comparison No.2 point 16 setting *2	(L)			
135	335		(H)			
136	336	Continuous comparison No.2 point monitor during comparison			Read only	
137 to 199	337 to 399	Reserved		----	----	----

* 1 Initial value which is set when the module is powered on or the programmable controller CPU is reset.

* 2 Read and write a value in 32-bit signed binary format. (Make sure to use a value in units of 2 words.)

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- The reserved areas in the above table and areas not mentioned in the table are for system use, not for users. If written by a user, the functions of the QD64D2 are not guaranteed.
- All data in the buffer memory of the QD64D2 are initialized when the module is powered on or the programmable controller CPU is reset. To save the necessary data, use the FROM/DFRO/TO/DTO instructions in the sequence program or make setting with the utility package for writing/reading of the buffer memory data.
- Since the buffer memory contents are automatically updated by count operation, the latest count value can be read from the buffer memory.

3.4.2 Details of the buffer memory

This section describes details of the QD64D2 buffer memory.
In this section, I/O numbers (X/Y) and buffer memory addresses are listed for channel 1 and coincidence output No.1. For I/O numbers and buffer memory addresses used for channel 2 and coincidence output No.2, refer to Section 3.3.1 and Section 3.4.1.

(1) Ring counter lower limit value (Un\G0 and 1)
Ring counter upper limit value (Un\G2 and 3)

- This area is used for setting a count range for the ring counter. (Refer to Section 5.2.2.)
- Setting range: -2147483648 to 2147483647

*1 Setting value of the ring counter upper limit value (Un\G2 and 3) and the ring counter lower limit value (Un\G0 and 1) becomes effective when the count enable command (Y06) is turned from OFF to ON.
*2 It does not become effective until the count enable command (Y06) is turned from OFF to ON.
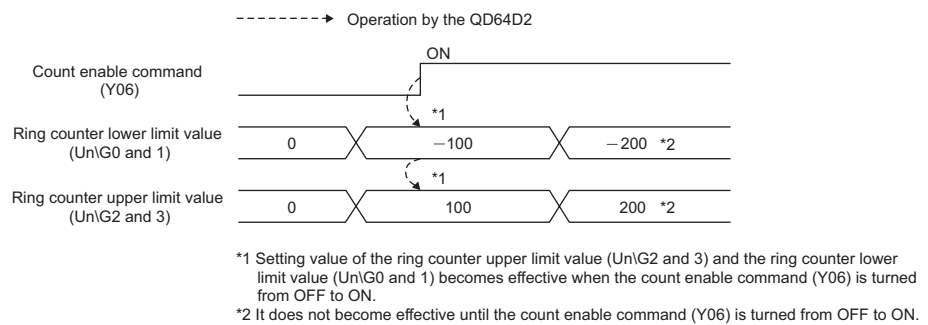
Figure 3.18 Timing chart for the ring counter lower limit value (Un\G0 and 1) and ring counter upper limit value (Un\G2 and 3)

(2) Preset value setting (Un\G4 and 5)

- This area is used for setting a preset value for the counter. (Refer to Section 5.4.)
- Setting range: -2147483648 to 2147483647
- The setting value becomes effective when the preset command (Y04) or the preset input terminal (PRST) is turned from OFF to ON.

* t≧2ms
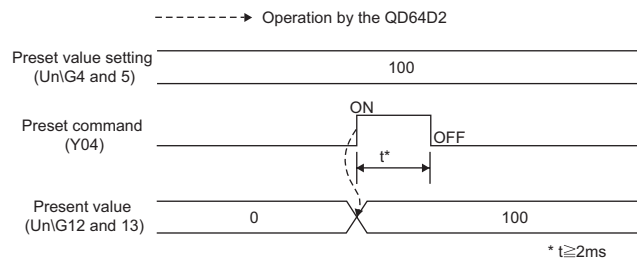
Figure 3.19 Timing chart for the preset value setting (Un\G4 and 5)

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(3) Coincidence output No.1 point setting (Un\G6 and 7)
    Coincidence output No.1 point change request (Un\G10)
    Coincidence output No.2 point setting (Un\G8 and 9)
    Coincidence output No.2 point change request (Un\G11)

- This area is used for setting the comparison point (the value used to compare with the present value) used for the coincidence output function.

- Setting procedure

  1) Write any comparison point to the coincidence output No.1 point setting (Un\G 6 and 7).
     Setting range: -2147483648 to 2147483647

  2) Write "1" (Change request) to the coincidence output No.1 point change request (Un\G10).

  3) The comparison point written to the coincidence output No.1 point setting (Un\G6 and 7) becomes effective, and the coincidence output No.1 point change request (Un\G10) changes from "1" to "0" (No change request).

  4) The comparison between the set comparison point and the present value is executed.

  Note) If a value other than "1" is written to the coincidence output No.1 point change request, the comparison point written to the coincidence output No.1 point setting does not become effective.
  For the comparison point, a value previously set in the coincidence output No.1 point setting is used.

  For example, the default value of the coincidence output No.1 point setting is "0". If "10000" is written to the coincidence output No.1 point setting, the default value of "0" is used for the comparison point unless "1" is written to the coincidence output No.1 point change request.

- The above procedure is described as an example of the coincidence output No.1. To set the coincidence output No.2, replace the coincidence output No.1 setting (Un\G6 and 7) and the coincidence output No.1 point change request (Un\G10) with the coincidence output No.2 point setting (Un\G8 and 9) and the coincidence output No.2 point change request (Un\G11).
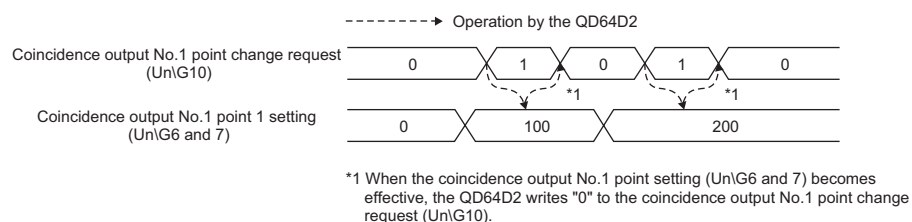
Figure 3.20 Timing chart for the coincidence output No.1 point setting (Un\G6 and 7) and the coincidence output No.1 point change request (Un\G10)

- For details of the operation, refer to Section 5.3.1.

(4) Present value (Un\G12 and 13)

- Present value of the counter is stored in this area.
- Setting range: -2147483648 to 2147483647
- An example when the pulse input mode is CW/CCW is shown below.
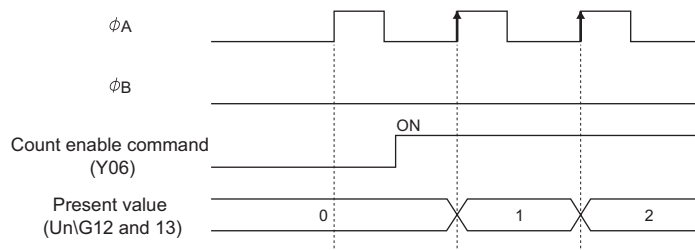
Figure 3.21 Timing chart of the present value (Un\G12 and 13)

(5) Latch count value (Un\G14 and 15)

- The latched value of the present value (Un\G12 and 13) is stored in this area. (Refer to Section 5.5.)
- When one of the following conditions is satisfied, the present value (Un\G12 and 13) is stored in the latch count value (Un\G14 and 15).

  1) When turning from OFF to ON the latch counter execution command (Y07)

  2) When turning from OFF to ON the latch counter input terminal (LATCH)

- Setting range: -2147483648 to 2147483647
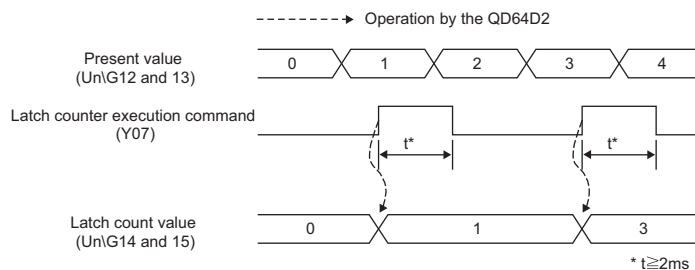
Figure 3.22 Timing chart for the latch count value (Un\G14 and 15)

(6) Overflow detection flag (Un\G16)

- Overflow occurrence status of the counter is stored in this area. (Refer to Section 5.2.1.)
    - 0: No detection
    - 1: Overflow occurred
- Overflow occurs when the count value exceeds the range of -2147483648 to 2147483647.
- The overflow detection flag (Un\G16) can be cleared by the preset command (Y04) or the preset input terminal (PRST).
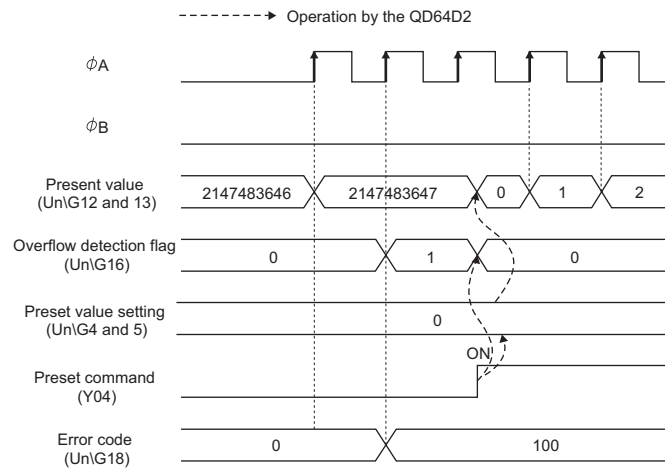
Figure 3.23 Timing chart for the overflow detection flag (Un\G16) (when the pulse input mode is 1 multiple of 1 phase)

(7) External I/O status monitor (Un\G17)

- The I/O status of the external device connector is stored in this area.
- Storage contents is as follows.
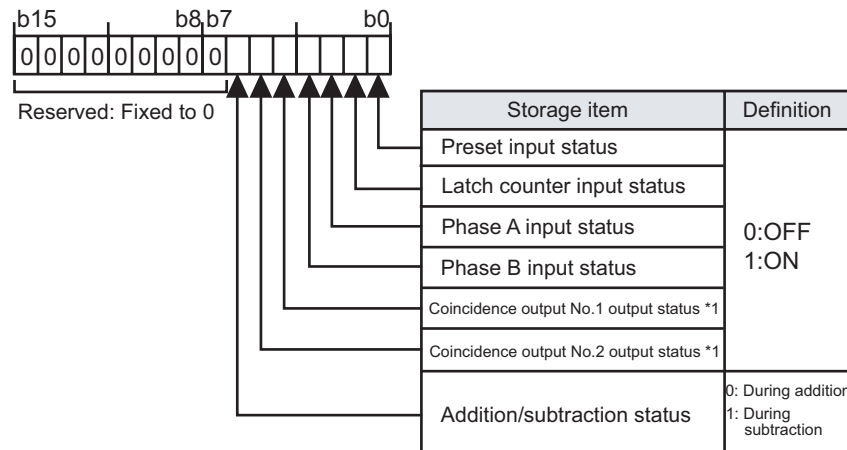
Figure 3.24 Storage contents of the external I/O status monitor (Un\G17)

- Storage item marked with "*1" turns to "1" (ON) regardless of applying a voltage to the external coincidence output power supply terminal.
- It takes up to 2ms until actual I/O status is reflected to the external I/O status monitor (Un\G17).

(8) Error code (Un\G18)

- Error code of the detected error is stored in this area.
- For operations when multiple errors occur concurrently, refer to POINT in Section 8.11.1.

(9) Warning code (Un\G19)

- Warning code of the detected error is stored in this area.
- For operations when multiple warnings occur concurrently, refer to POINT in Section 8.11.2.

(10)Continuous comparison No.1 start point setting (Un\G50)
Continuous comparison No.2 start point setting (Un\G100)

- This area is used for setting a start point number of comparison for the continuous comparison function.
- Setting range: 1 to 16
- For details of setting and operation, refer to Section 5.3.2.

(11)Continuous comparison No.1 repeat point setting (Un\G51)
Continuous comparison No.2 repeat point setting (Un\G101)

- This area is used for setting a repeat point number of comparison for the continuous comparison function.
- Setting range: 1 to 16
- For details of setting and operation, refer to Section 5.3.2.

(12)Continuous comparison No.1 ON time setting (Un\G52)
Continuous comparison No.2 ON time setting (Un\G102)

- This area is used for setting ON time of the coincidence output terminal and the counter value coincidence.
- Setting range: 1 to 10 (Unit: ms)
- For determination of ON time, refer to Section 5.3.2 (4).
- For details of setting and operation, refer to Section 5.3.2.

(13)Continuous comparison No.1 point n setting (Un\G54 to 85)
Continuous comparison No.2 point n setting (Un\G104 to 135)

- This area is used for setting a continuous comparison point for the continuous comparison function.
- Setting range: -2147483648 to 2147483647
- For details of setting and operation, refer to Section 5.3.2.

(14)Continuous comparison No.1 point monitor during comparison (Un\G86)
Continuous comparison No.2 point monitor during comparison (Un\G136)

- Point number (1 to 16) which is currently in comparison with the present value is stored in this area.
- For details of setting and operation, refer to Section 5.3.2.

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3.5 Specifications of I/O Interfaces with External Device

3.5.1 Electrical specifications of I/O signals

(1) Input specifications

Table 3.6 Input specifications of the QD64D2

Signal name	Rated input voltage/ current	Operating voltage range	ON voltage/ current	OFF voltage/ current	Input resistance	Response time
Phase A pulse input	•RS-422-A compliant differential receiver (AM26C32 (manufactured by Texas Instruments Incorporated) or equivalent) V_{IT+} differential input ON voltage (H level threshold voltage) 0.1V					
Phase B pulse input	V_{IT-} differential input OFF voltage (L level threshold voltage) -0.1V Vhys Hysteresis voltage (V_{IT+} - V_{IT-}) 60mV (A current type line driver cannot be used.)					
Preset input	24VDC /5mA	21.6 to 26.4VDC	21.6 to 26.4VDC /2 to 5mA	5VDC or less /0.1mA or less	Approx. 10kΩ	OFF→ON 0.5ms or less ON→OFF 1.0ms or less
Latch counter input	24VDC /5mA	21.6 to 26.4VDC	21.6 to 26.4VDC /2 to 5mA	5VDC or less /0.1mA or less	Approx. 10kΩ	OFF→ON 0.5ms or less ON→OFF 1.0ms or less
External coincidence output power supply 12/24V	12 or 24VDC /8mA (TYP 24VDC)	10.2 to 30VDC	----	----	Approx. 3.9kΩ	----

(2) Output specifications

Table 3.7 Output specifications of the QD64D2

Signal name	Rated load voltage	Operating load voltage range	Maximum load current/rush current	Maximum voltage drop at ON	Leakage current at OFF	Response time (rated load, resistance load)
Coincidence output No.1	12/24VDC	10.2 to 30VDC	0.5A/point 2A/common	1.5VDC	0.1mA or less	OFF→ON 0.05ms or less ON→OFF 0.1ms or less
Coincidence output No.2						

3.5.2 Signal layout for external device connector

The specifications of the connector section, which is the I/O interface for the QD64D2 and external device, are shown below.
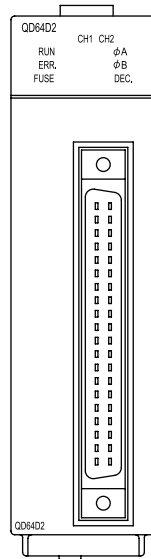
Figure 3.25 Appearance of the QD64D2

Table 3.8 Signal layout for external device connector

Terminal layout	CH1		CH2	
	Terminal number	Signal name	Terminal No.	Signal name
	B20	NC	A20	NC
	B19	PULSE A +	A19	PULSE A +
	B18	PULSE A -	A18	PULSE A -
	B17	PULSE B +	A17	PULSE B +
	B16	PULSE B -	A16	PULSE B -
	B15	PULSE COM	A15	PULSE COM
	B14	NC	A14	NC
	B13	PRST COM	A13	PRST COM
	B12	PRST	A12	PRST
	B11	NC	A11	NC
	B10	NC	A10	NC
	B09	LATCH COM	A09	LATCH COM
	B08	LATCH	A08	LATCH
	B07	NC	A07	NC
	B06	NC	A06	NC
	B05	EQU1	A05	EQU1
	B04	EQU2	A04	EQU2
	B03	12V/24V	A03	12V/24V
Front view of the module	B02	0V	A02	0V
	B01	NC	A01	NC

3.5.3   List of I/O signal details

The details of each signal for the QD64D2 external device connector are shown below.

Table 3.9 Details of each signal for external device connector

Signal name	Terminal number		Symbol	Signal details
	CH1	CH2		
Phase A pulse input +	B19	A19	PULSE A +	•Inputs + (plus) side of phase A pulse.
Phase A pulse input -	B18	A18	PULSE A -	•Inputs - (minus) side of phase A pulse.
Phase B pulse input +	B17	A17	PULSE B +	•Inputs + (plus) side of phase B pulse.
Phase B pulse input -	B16	A16	PULSE B -	•Inputs - (minus) side of phase B pulse.
Pulse input common	B15	A15	PULSE COM	•Common for pulse input •It is common between channels.
Preset input common	B13	A13	PRST COM	•Common for preset input •It is separated between channels.
Preset input 24V	B12	A12	PRST	•Turn ON to execute the preset by the external signal. •When the preset input terminal (PRST) is turned ON, the present value (Un\G12 and 13) is changed to the preset value setting (Un\G4 and 5).
Latch counter input common	B09	A09	LATCH COM	•Common for latch counter input •It is separated between channels.
Latch counter input 24V	B08	A08	LATCH	•Turn ON to latch the present value (Un\G12 and 13) by the external signal. •When the latch counter input terminal (LATCH) is turned ON, the present value (Un\G12 and 13) is latched and stored in the latch count value (Un\G14 and 15).
Coincidence output No.1	B05	A05	EQU1	Executes the coincidence output when a coincidence of the count value is detected while using the coincidence output function or the continuous comparison function.
Coincidence output No.2	B04	A04	EQU2	
External coincidence output power supply 12/24V	B03	A03	12V/24V	•Supplies 12V or 24V when executing the external coincidence output. •It is common between channels.
External coincidence output power supply GND(0V)	B02	A02	0V	•Inputs 0V when executing the external coincidence output. •It is also used as a common for external coincidence output. •It is common between channels.

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3.5.4 Interface for external device

The following table shows the list of external device interface of the QD64D2.

Table 3.10 List of external device interface of the QD64D2

I/O classification	Internal circuit	Terminal number CH1	Terminal number CH2	Signal name
Input		B19	A19	Phase A pulse input +
		B18	A18	Phase A pulse input -
		B17	A17	Phase B pulse input +
		B16	A16	Phase B pulse input -
		B15, A15		Pulse input common
		B12	A12	Preset input 24V
		B13	A13	Preset input common
		B08	A08	Latch counter input 24V
		B09	A09	Latch counter input common
Output		B05	A05	Coincidence output No.1
		B04	A04	Coincidence output No.2
		B03, A03		External coincidence output power supply 12/24V
		B02, A02		External coincidence output power supply GND (0V)

3.6 Connectable Encoders

The encoders connectable to the QD64D2 are described below.

• Line driver output type encoders

(Check that the encoder output voltage meets the specifications of the QD64D2.)

CHAPTER4   PROCEDURES AND SETTINGS BEFORE OPERATION

This chapter describes the operating procedures before operation, part names, settings, and wiring of the QD64D2.

4.1   Handling Precautions

This section describes precautions on handling the QD64D2.

(1) Do not drop the module case and/or connector or apply a strong impact to it.

(2) Do not remove the printed-circuit board of the module from the case. Doing so will cause a failure.

(3) Be careful to prevent foreign matter such as dust or wire chips from entering the module.
Failure to do may cause a fire, failure or malfunction.

(4) A protective film is attached to the module top to prevent foreign matter such as wire chips from entering the module during wiring.
Do not remove the film during wiring.
Be sure to remove it for heat dissipation before system operation.

(5) Tighten the screws such as module fixing screws within the following ranges.

Table 4.1 Tightening torque range of module fixing screw

Screw	Tightening torque range
Module fixing screw (M3)[1]	0.36 to 0.48 N•m
Connector screw of module (M2.6)	0.20 to 0.29 N•m

* 1 The module can be easily fixed onto the base unit using the hook at the top of the module. However, it is recommended to secure the module with the module fixing screw if the module is subject to significant vibration.

(6) When mounting the module to the base unit, insert the module fixing projection into the fixing hole in the base unit, and mount the module with using the hole as a supporting point.
Incorrect module mounting may cause a malfunction, failure, or drop of the module.

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4.2 Procedures before Operation

The following flowchart shows the procedures for operating the QD64D2.
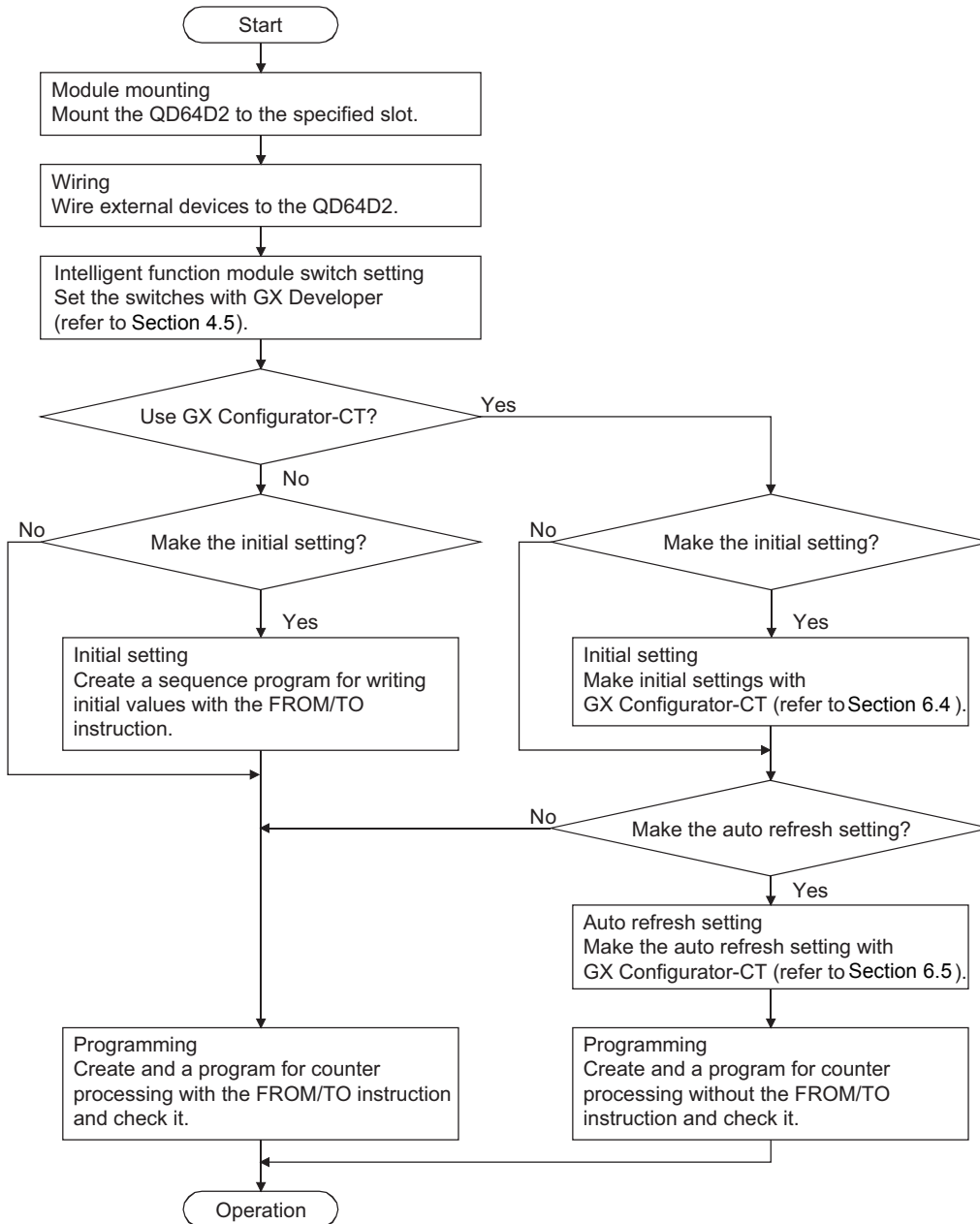
Figure 4.1 Procedures before operation

4.3 Part Names

The following explains the part names of the QD64D2.
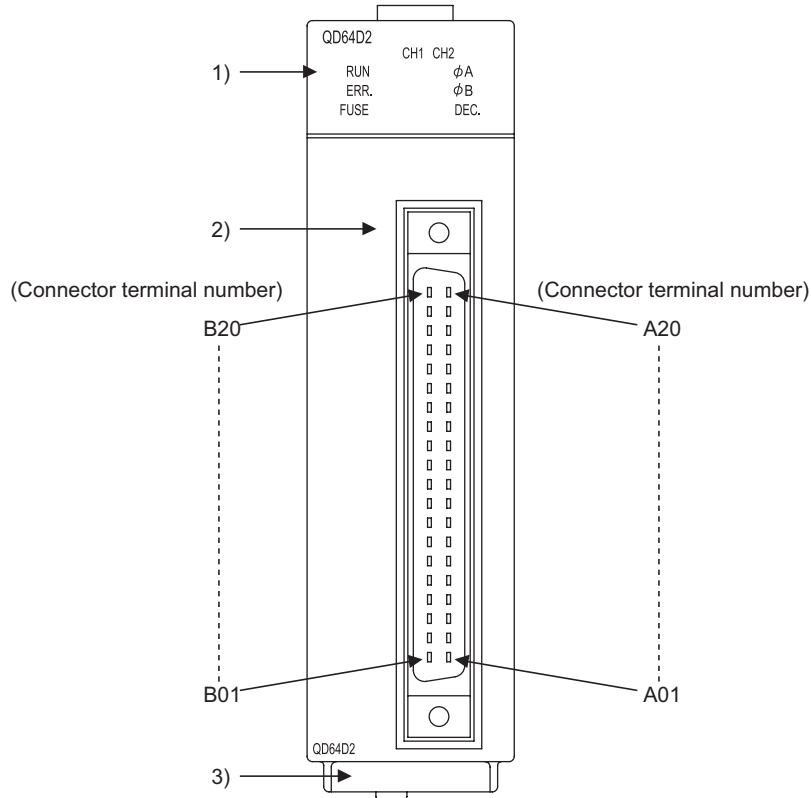
Figure 4.2 Appearance of the QD64D2

Table 4.2 Part names

	Name		Description
1)	LED indicator	RUN	Indicates operating status of the QD64D2. ON: Normal operation OFF: Watchdog timer error
		ERR.	Indicates error status of the QD64D2. ON: Error at 1 CH or more. OFF: All channels in normal operation
		FUSE	Indicates fuse status of external coincidence output part. ON: Blown fuse detected OFF: Blown fuse not detected
		φA_CH1 to CH2	Indicates input status of A- phase pulse terminal. ON: Pulse ON OFF: Pulse OFF
		φB_CH1 to CH2	Indicates input status of B- phase pulse terminal. ON: Pulse ON OFF: Pulse OFF
		DEC._CH1 to CH2	Indicates subtraction status of a count. ON: During subtraction OFF: During addition
2)	External device connector (40 pins)		A connector for connecting an encoder and controller For terminal layout, refer to Section 3.5.
3)	Serial number plate		Indicates the serial No. of the QD64D2.

⊠POINT

Even if the fuse of the external coincidence output part is blown, the FUSE LED does not turn ON unless a voltage is applied to the external coincidence output power supply terminal.

(1) Connectors for external wiring

Purchase the connector for the QD64D2 separately.
The following tables show the recommended connector types and crimp tool.

(a) Connector types

Table 4.3 Connector types

Type	Model
Soldering type, straight out	A6CON1
Crimp type, straight out	A6CON2
Soldering type, usable for both straight out and diagonal out	A6CON4

* The A6CON3 connector (pressure welding type, straight out) cannot be used for the QD64D2.

(b) Connector crimp tool

Table 4.4 Connector crimp tool

Type	Model	Applicable wire size	Contact
Crimp tool	FCN-363T-T005/H	AWG28 to 24	FUJITSU COMPONENT LIMITED

4.4 Wiring

This section describes wiring an encoder and controller to the QD64D2.

4.4.1 Wiring precautions

One of the conditions to maximize the QD64D2 functions and make the system high-reliable, the external wiring has to be laid so that the QD64D2 becomes less subject to noise.
This section describes the precautions on external wiring.

(1) Inputting a signal of different voltage may result in a malfunction or mechanical failure.

(2) For 1-phase input, always perform pulse input wiring on the phase A side.

(3) When pulse status noise is input, the QD64D2 may miscount.

(4) Take the following measures against noise for high-speed pulse input.

(a) Always use a shielded twisted pair cable and ground it on the QD64D2 side.

(b) Wire the shielded twisted pair cables so as not to be in parallel with wires causing much noise such as power lines or I/O wires while keeping a distance of at least 150 mm (5.91 inch) between such wires. Also install the shielded twisted pair cables as short as possible.

(5) The following diagram shows an example of wiring for measures against noise.
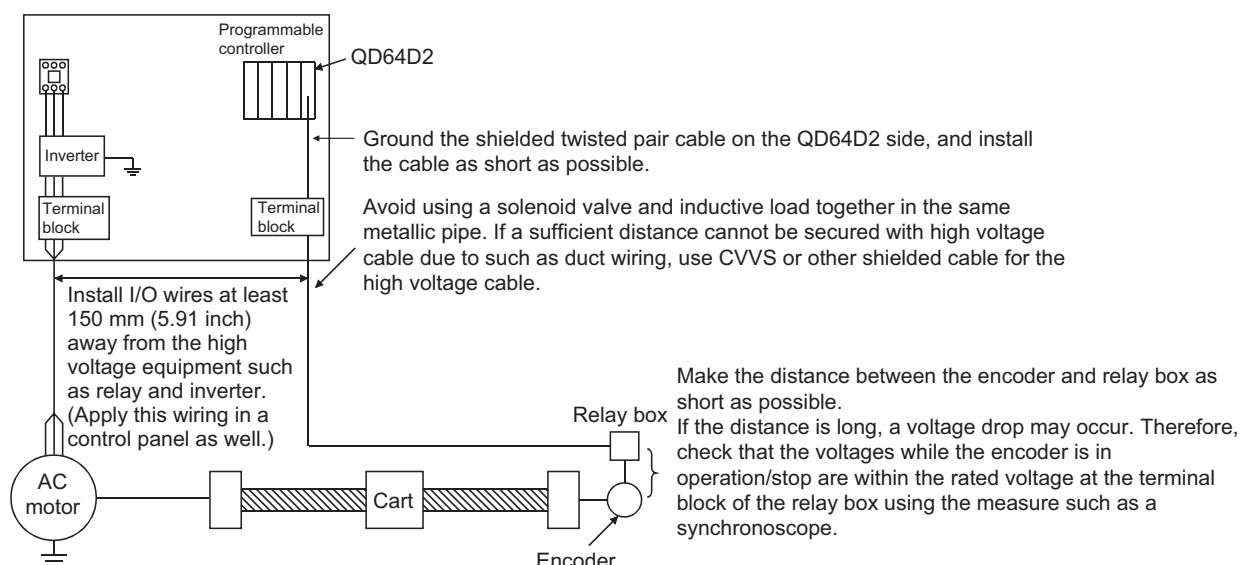
Figure 4.3 Example of wiring for measures against noise

(6) Take the following measures to conform the wiring to the EMC and Low Voltage Directives.

(a) Ground the shielded twisted pair cables to a control panel with the AD75CK cable clamp (manufactured by Mitsubishi Electric Corporation)

In a control panel

QD64D2

20cm (7.87inch) to 30cm (11.81inch)
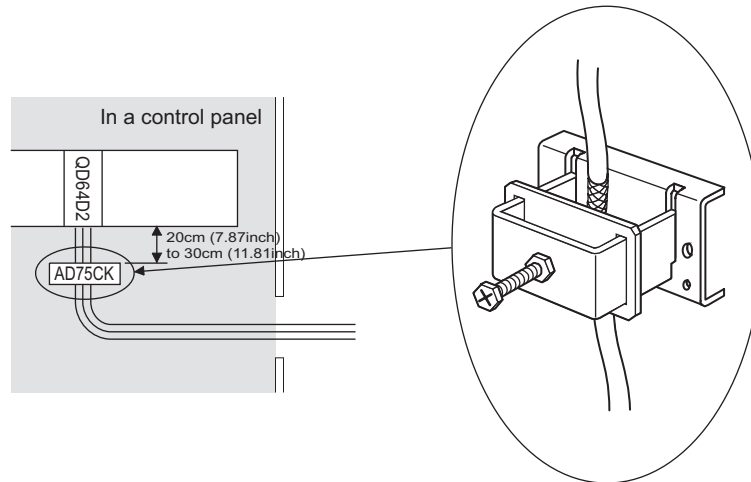
AD75CK

Figure 4.4 AD75CK cable clamp

For the AD75CK, refer to the following manual.

☞ AD75CK-type Cable Clamping Instruction Manual

(b) The power supply line connecting to the external coincidence output power supply module should be 10m or less long.

(c) Keep the length of the cable connected to the external devices of the QD64D2 to 30m or less.

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4.4.2 Example of wiring the module and an encoder

Alphanumeric characters in parentheses of QD64D2 terminal parts indicate CH2 terminal numbers.

(1) Example of wiring with a line driver (AM26LS31 equivalent) encoder
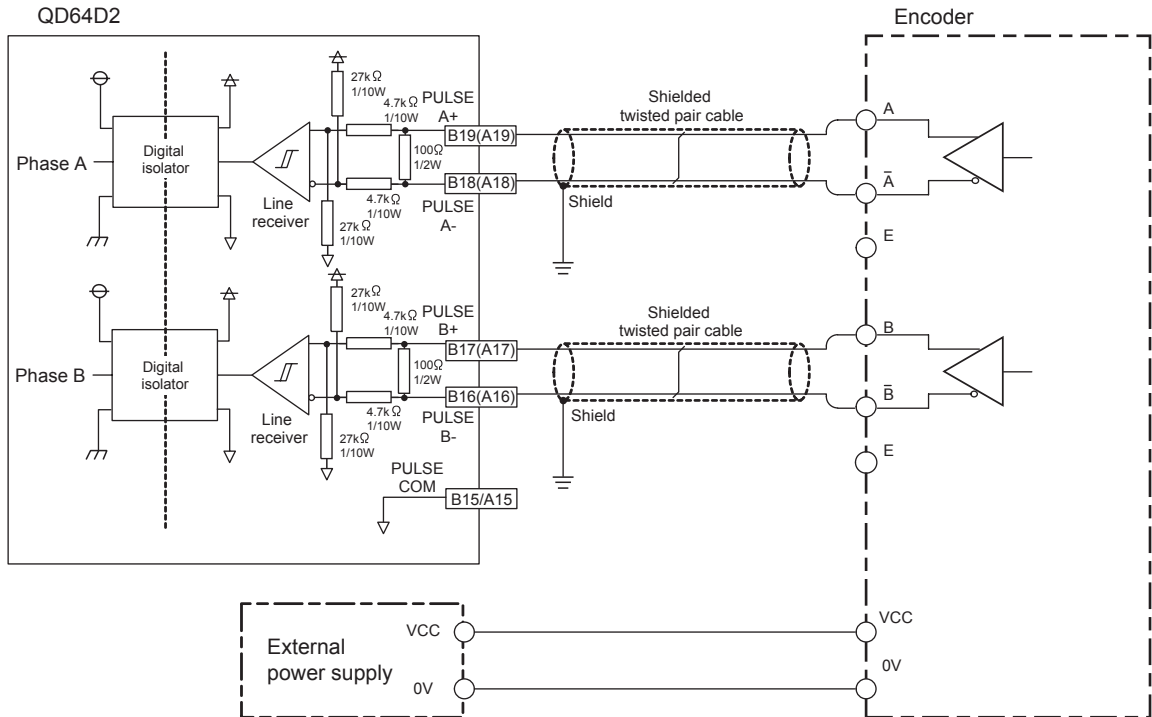
Figure 4.5 Example of wiring with a line driver (AM26LS31 equivalent) encoder

4.4.3 Example of wiring a controller and an external input terminal

Alphanumeric characters in parentheses of QD64D2 terminal parts indicate CH2 terminal numbers.

(1) Example of wiring with a controller (sink loading type)
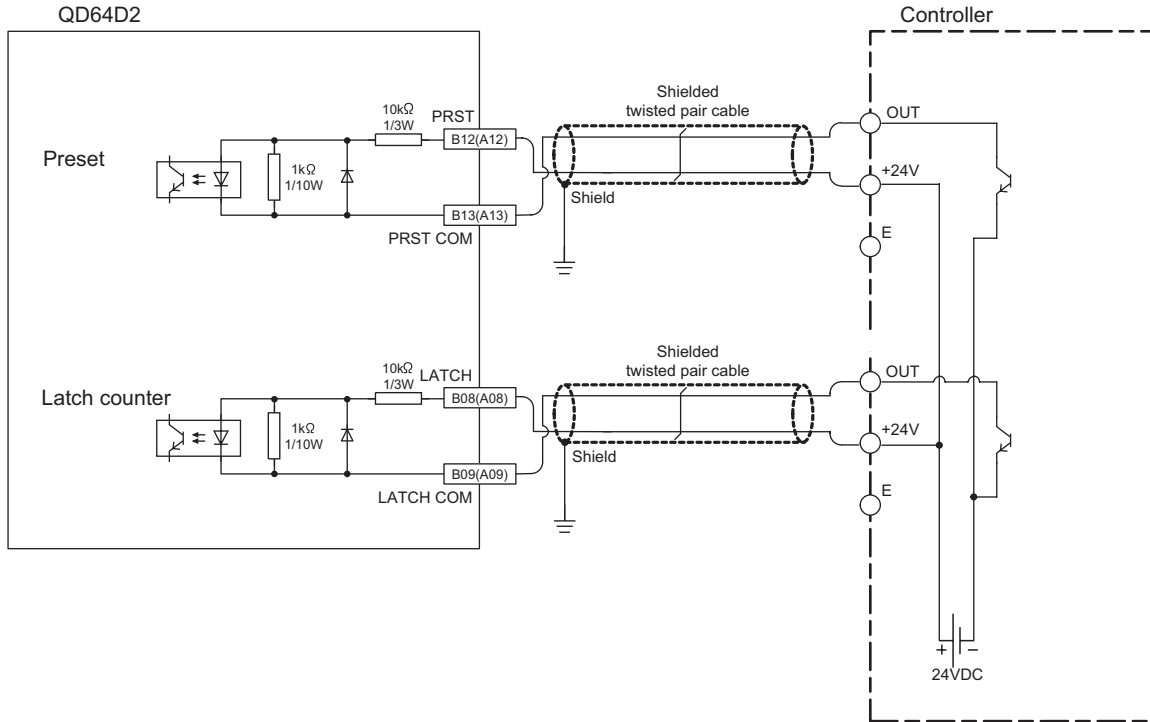
Figure 4.6 Example of wiring with a controller (sink loading type)

(2) Example of wiring with a controller (source loading type)
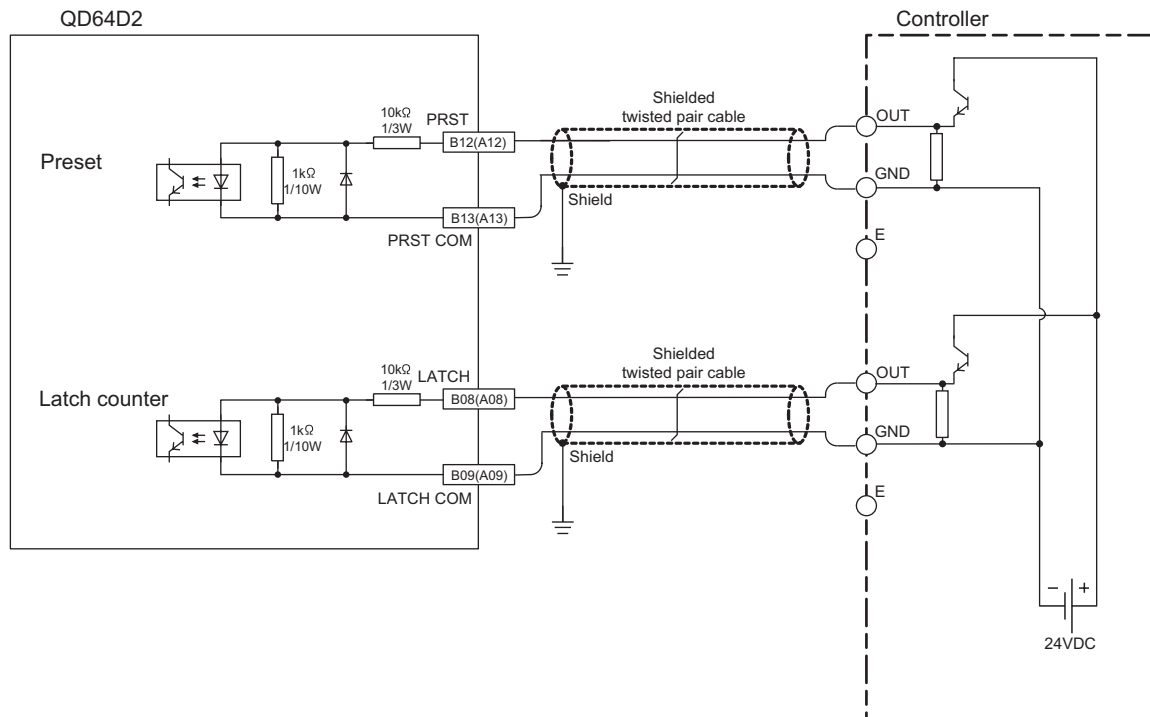
Figure 4.7 Example of wiring with a controller (source loading type)

4.4.4　Example of wiring with an external output terminal

When using coincidence output No. 1 terminal (EQU1) and coincidence output No. 2 terminal (EQU2), external power supply of 10.2 to 30VDC is required.
Figure 4.8 shows wiring example.
Alphanumeric characters in parentheses of QD64D2 terminal parts indicate CH2 terminal numbers.

(1) Example of wiring with an external output terminal (sink output type)
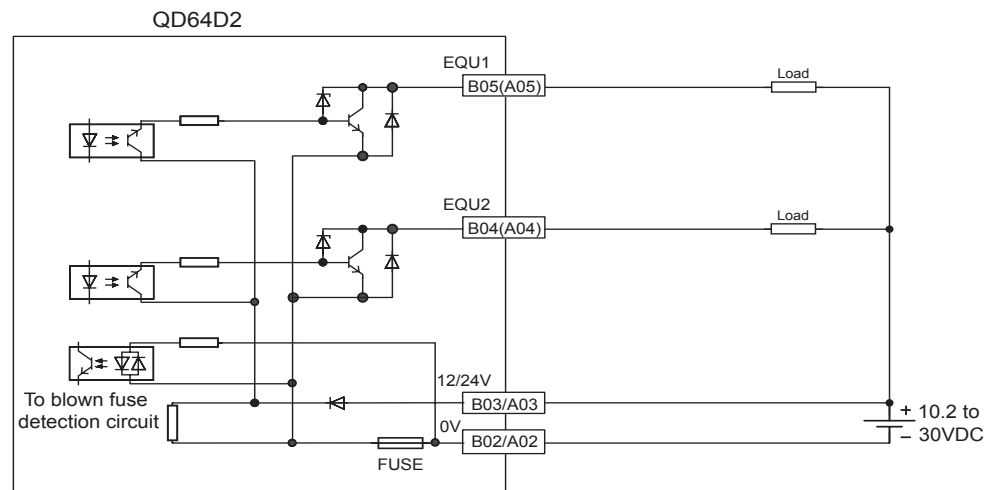
Figure 4.8 Example of wiring with an external output terminal (sink output type)

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4.5   Intelligent Function Module Switch Setting
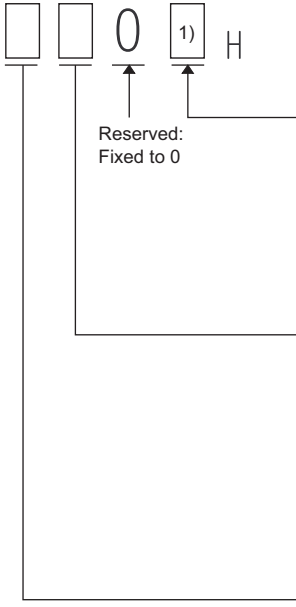
This section describes the intelligent function module switch setting.
The switch setting is made on the [I/O assignment] screen of GX Developer.

(1) Intelligent function module switch setting
The switch has five switches and is set at 16-bit data.
When the switch setting is not made, the default values of the switches from 1 to 5 are 0.

Table 4.5 Intelligent function module switches

	Setting item	Setting value	Default

Switch 1 (CH1)		1) Pulse input mode
		  0_H: 1 multiple of 1 phase
		  1_H: 2 multiples of 1 phase
		  2_H: CW/CCW
		  3_H: 1 multiple of 2 phases
		  4_H: 2 multiples of 2 phases
		  5_H: 4 multiples of 2 phases
		
		2) Counter format
		  0_H : Linear counter
		  1_H : Ring counter
		
		3) Counter value comparison function election
		  0_H : Coincidence output function
		  1_H : Continuous comparison function
			0000_H

Switch 2 (CH2)	Same as for the switch 1	0000_H
Switch 3	Reserved: Fixed to 0	
Switch 4	Reserved: Fixed to 0	
Switch 5	Reserved: Fixed to 0	

(Example) Target channel: channel 1, pulse input mode setting: 1 multiple of 2 phases, counter format: ring counter, and counter value comparison function selection: continuous comparison function

Set the switch 1 = 1103$_H$.

⊠POINT

The reserved bits in Table 4.5 are for system use, not for users.
Therefore, always fix them to 0. If used (changed from 0 to 1) by a user, the functions of the QD64D2 are not guaranteed.

(2) Details of the intelligent function module switch setting

Table 4.6 Details of the intelligent function module switch setting

Setting item	Description	Reference
Pulse input mode	Set the pulse input mode for each channel. When setting 6$_H$ to F$_H$, a switch setting error (error code: 810) occurs.	Section 5.1.1
Counter format	Set the counter format for each channel.	Section 5.2.1 Section 5.2.2
Counter value comparison function selection	Set the counter value comparison function for each channel.	Section 5.3.1 Section 5.3.2

(3) Operating procedure

Set the switches on the [I/O assignment] screen of GX Developer.

(a) [I/O assignment] screen

Make the following settings to the slot to which the QD64D2 is mounted.

[Type]: Select [Intelli].

[Model name]: Input the model of the module.

[Points]: Select [32points].

[Start XY]: Input the start I/O number of the QD64D2.
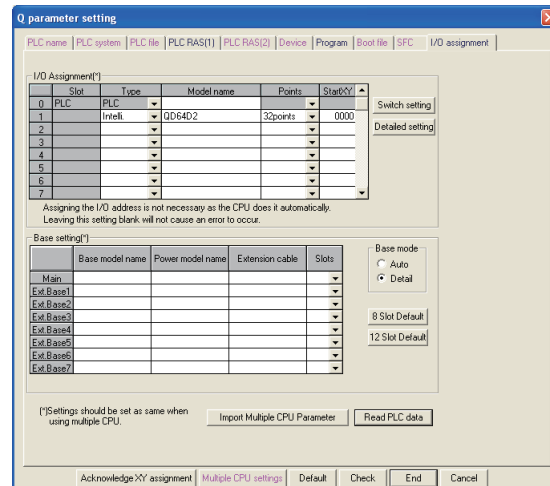
Figure 4.9 Setting example of [I/O assignment]

(b) [Switch setting for I/O and intelligent function module] screen

Click the Switch setting on the [I/O assignment] screen to display the screen below and set the switches from 1 to 5.

Entering the values in hexadecimal make the setting easier.

Change [Input format] to [HEX.] and enter values.
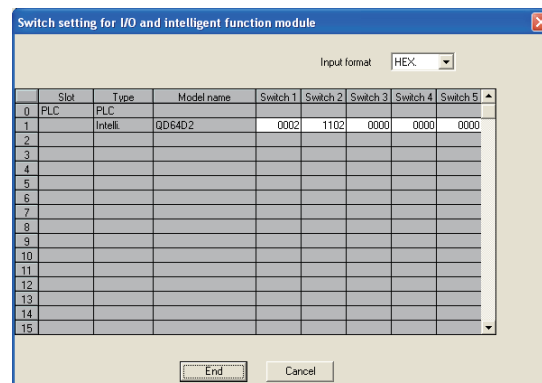
Figure 4.10 [Switch setting for I/O and intelligent function module] screen

⊠**POINT**

Since [Error time output mode] and [H/W error time PLC operation mode] on the [Switch setting for I/O and intelligent function module] screen are disabled to the QD64D2, the settings are unnecessary.

CHAPTER5   FUNCTIONS

This chapter describes functions of the QD64D2.

5.1   Pulse Input and Count Methods

5.1.1   Types of the pulse input method

The pulse input method has six types as shown on Table 5.1.
This chapter describes I/O numbers (X/Y) of channel 1 only.
For I/O numbers (X/Y) of channel 2, refer to Section 3.3.1.
Set the count method with the intelligent function module switch setting of GX Developer
(refer to Section 4.5).

Table 5.1 Types of the pulse input method

Pulse input method	Count timing		
1 multiple of 1 phase	For addition count	ϕA ϕB (and subtraction count command (Y05))	Counts on the rising edge (↑) of ϕA. ϕB and the subtraction count command (Y05) are OFF.
	For subtraction count	ϕA ϕB (or subtraction count command (Y05))	Counts on the falling edge (↓) of ϕA. ϕB or the subtraction count command (Y05) is ON.
2 multiples of 1 phase	For addition count	ϕA ϕB (and subtraction count command (Y05))	Counts on the rising (↑) and falling (↓) edges of ϕA. ϕB and the subtraction count command (Y05) are OFF.
	For subtraction count	ϕA ϕB (or subtraction count command (Y05))	Counts on the rising (↑) and falling (↓) edges of ϕA. ϕB or the subtraction count command (Y05) is ON.
CW/CCW	For addition count	ϕA ϕB	Counts on the rising edge (↑) of ϕA. ϕB is OFF.
	For subtraction count	ϕA ϕB	ϕA is OFF. Counts on the rising edge (↑) of ϕB.
1 multiple of 2 phases	For addition count	ϕA ϕB	When ϕB is OFF, counts on the rising edge (↑) of ϕA.
	For subtraction count	ϕA ϕB	When ϕB is OFF, counts on the falling edge (↓) of ϕA.

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Table 5.1 Types of the pulse input method (continued)

Pulse input method	Count timing		
2 multiples of 2 phases	For addition count	ϕA, ϕB	When ϕB is OFF, counts on the rising edge (↑) of ϕA. When ϕB is ON, counts on the falling edge (↓) of ϕA.
	For subtraction count	ϕA, ϕB	When ϕB is ON, counts on the rising edge (↑) of ϕA. When ϕB is OFF, counts on the falling edge (↓) of ϕA.
4 multiples of 2 phases	For addition count	ϕA, ϕB	When ϕB is OFF, counts on the rising edge (↑) of ϕA. When ϕB is ON, counts on the falling edge (↓) of ϕA. When ϕA is ON, counts on the rising edge (↑) of ϕB. When ϕA is OFF, counts on the falling edge (↓) of ϕB.
	For subtraction count	ϕA, ϕB	When ϕB is ON, counts on the rising edge (↑) of ϕA. When ϕB is OFF, counts on the falling edge (↓) of ϕA. When ϕA is OFF, counts on the rising edge (↑) of ϕB. When ϕA is ON, counts on the falling edge (↓) of ϕB.

⊠**POINT**

When performing control with phase B pulse input or the subtraction count command (Y05) at 1-phase pulse input, always turn OFF the unused signals. If either of phase B pulse input or the subtraction count command (Y05) is ON, subtraction count is performed at phase A pulse input.

5.2 Selecting a Counter Format

The counter format has the following two types.
Select a counter format using the intelligent function module switch setting of GX Developer. (Refer to Section 4.5.)

- Linear counter

- Ring counter

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5.2.1   Selecting the linear counter

(1) Linear counter operation

(a) For the linear counter, the counting is executed within the range of -2147483648 to 2147483647.
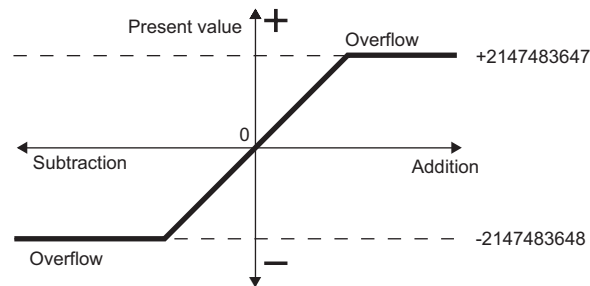
Figure 5.1 Operation image of the linear counter

(b) The following functions can be used in combination.
- Counter value comparison function (Coincidence output function, continuous comparison function)
- Coincidence detection interrupt function
- Preset function
- Latch counter function

(2) Overflow error

(a) If the present value (Un\G12 and 13) exceeds the range of -2147483648 to 2147483647, an overflow error occurs.

(b) The following are processed at the overflow error.
- The counting stops. Even if a pulse is input at this status, the present value (Un\G12 and 13) remains at -2147483648 or 2147483647.
- "1" is stored in the overflow detection flag (Un\G16).
- The error occurrence (X0D) turns ON, and the error code 100 is stored in the error code (Un\G18).

(c) The overflow error can be cleared by setting the present value (Un\12 and 13) within the range of -2147483648 to 2147483647 using the preset function.
When the overflow error is cleared, "0" is stored in the overflow detection flag (Un\G16) and the counting can be restarted.
However, the error occurrence (X0D) remains ON and the stored value of the error code (Un\G18) is held even after presetting.
Turn ON the error reset command (Y0D) to reset the error.

5.2.2 Selecting the ring counter

(1) Ring counter operation

(a) For the ring counter, the counting is executed repeatedly within the range set by the ring counter lower limit value (Un\G0 and 1) and the ring counter upper limit value (Un\G2 and 3).

Overflow error does not occur.
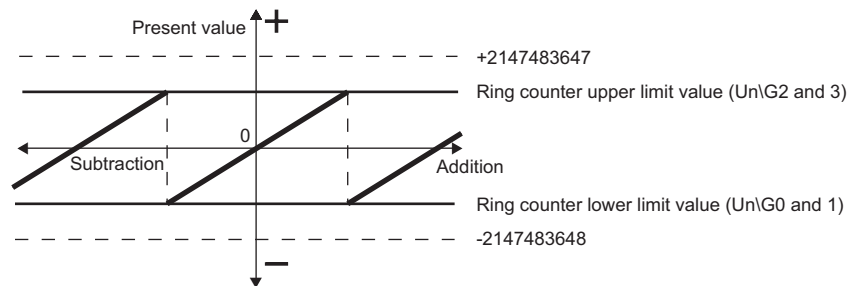
Figure 5.2 Operation image of the ring counter

(b) The following functions can be used in combination.
- Counter value comparison function (Coincidence output function, continuous comparison function)
- Coincidence detection interrupt function
- Preset function
- Latch counter function

(2) Count range of the ring counter

(a) Count range is the following three types shown in Table 5.2
  - Count range is determined by the ring counter lower limit value (Un\G0 and 1), the ring counter upper limit value (Un\G2 and 3) and the present value (Un\G12 and 13).
  - Range 1 and 2 in Table 5.2 are examples with the following setting.
  Ring counter lower limit value (Un\G0 and 1) = -50000
  Ring counter upper limit value (Un\G2 and 3) = 100000

Table 5.2 Count range of the ring counter

Count range	Setting condition
Range 1 + 2147483647 Ring counter upper limit value Subtraction Ring counter lower limit value — Addition - 2147483648 Count range -50000 to 99999	$\left(\begin{array}{c}\text{Ring counter lower}\\ \text{limit value}\\ \text{(Un\G0 and 1)}\end{array}\right) \leqq \left(\begin{array}{c}\text{Present value}\\ \text{(Un\G12 and 13)}\end{array}\right) \leqq \left(\begin{array}{c}\text{Ring counter upper}\\ \text{limit value}\\ \text{(Un\G2 and 3)}\end{array}\right)$ and $\left(\begin{array}{c}\text{Ring counter lower}\\ \text{limit value}\\ \text{(Un\G0 and 1)}\end{array}\right) \neq \left(\begin{array}{c}\text{Ring counter upper}\\ \text{limit value}\\ \text{(Un\G2 and 3)}\end{array}\right)$
Range 2 + 2147483647 Ring counter upper limit value Subtraction Addition Ring counter lower limit value - 2147483648 Count range -2147483648 to -50000 / 100001 to 2147483647	$\left(\begin{array}{c}\text{Present value}\\ \text{(Un\G12 and 13)}\end{array}\right) < \left(\begin{array}{c}\text{Ring counter lower}\\ \text{limit value}\\ \text{(Un\G0 and 1)}\end{array}\right)$ or $\left(\begin{array}{c}\text{Present value}\\ \text{(Un\G12 and 13)}\end{array}\right) > \left(\begin{array}{c}\text{Ring counter upper}\\ \text{limit value}\\ \text{(Un\G2 and 3)}\end{array}\right)$
Range 3 + 2147483647 Ring counter upper limit value Ring counter lower limit value Subtraction Addition - 2147483648 Count range -2147483648 to 2147483647	$\left(\begin{array}{c}\text{Ring counter lower}\\ \text{limit value}\\ \text{(Un\G0 and 1)}\end{array}\right) = \left(\begin{array}{c}\text{Ring counter upper}\\ \text{limit value}\\ \text{(Un\G2 and 3)}\end{array}\right)$ The present value (Un\G12 and 13) is not included in the setting condition.

(b) Setting method of the count range

1) Select a count range from range 1 to 3.

2) Preset the present value (Un\G12 and 13) in accordance with the setting condition. (Only when using a range 1 or 2)
   - Set the preset value setting (Un\G4 and 5).
   - Turn from OFF to ON the preset command (Y04), or turn ON the preset input terminal (PRST) for external input.

3) Set a count range for the ring counter.
   - Set the ring counter lower limit value (Un\G0 and 1) and the ring counter upper limit value (Un\G2 and 3).
   - Turn from OFF to ON the count enable command (Y06).

(c) When the ring counter lower limit value (Un\G0 and 1) and the ring counter upper limit value (Un\G2 and 3) are set as shown below and turn from OFF to ON the count enable command (Y06), a ring counter upper/lower limit value setting error (Error code: 500) occurs.

$$\left(\begin{array}{c} \text{Ring counter} \\ \text{lower limit value} \\ \text{(Un\G0 and 1)} \end{array} \right) \quad > \quad \left(\begin{array}{c} \text{Ring counter} \\ \text{upper limit value} \\ \text{(Un\G2 and 3)} \end{array} \right)$$

⊠POINT

- The present value (Un\G12 and 13) can be preset during counting. However, the changes for the ring counter lower limit value (Un\G0 and 1) and the ring counter upper limit value (Un\G2 and 3) become valid only after turning from OFF to ON the count enable command (Y06).
- When changing the count range by the preset, to avoid miss-counting, always turn OFF the count enable command (Y06) before changing it.

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5.3   Using the Counter Value Comparison Function

The counter value comparison function compares the present value (Un\G12 and 13) to a comparison point, and outputs the comparison result by the input signal (X01 to X06) or the external output (EQU1 and EQU2).

The counter value comparison function has the following two types.
Select a counter value comparison function using the intelligent function module switch setting. (Refer to Section 4.5.)

- Coincidence output function

- Continuous comparison function

5.3.1 Using the coincidence output function

Each channel has No.1 and No.2 comparison points. Each point individually compares to the present value (Un\G12 and 13) and outputs the comparison result. (Refer to Table 5.3.)

One comparison point can be set for each No.1 and No.2.

Table 5.3 Coincidence output function

Comparison point		Signal and external output terminal used to output the comparison result	
		Input signal (X)	External output
No.1	Coincidence output No.1 point setting (Un\G6 to 7)	•Counter value large No.1 (X01) •Counter value coincidence No.1 (X02) •Counter value small (X03)	Coincidence output No.1 terminal (EQU1)
No.2	Coincidence output No.1 point setting (Un\G8 to 9)	•Counter value large No.2 (X04) •Counter value coincidence No.2 (X05) •Counter value small No.2 (X06)	Coincidence output No.2 terminal (EQU2)

In this section, I/O numbers (X/Y) and buffer memory addresses are listed for channel 1 and coincidence output No.1. For I/O numbers and buffer memory addresses used for channel 2 and coincidence output No.2, refer to Section 3.3.1 and Section 3.4.1.

(1) Operation of coincidence output function

At the point where the coincidence output No.1 point change request (Un\G10) changes from "1" (Change request) to "0" (No change request), the comparison between the value set in the coincidence output No.1 point setting (Un\G6 and 7) (1000) and the present value (Un\G12 and 13) starts.
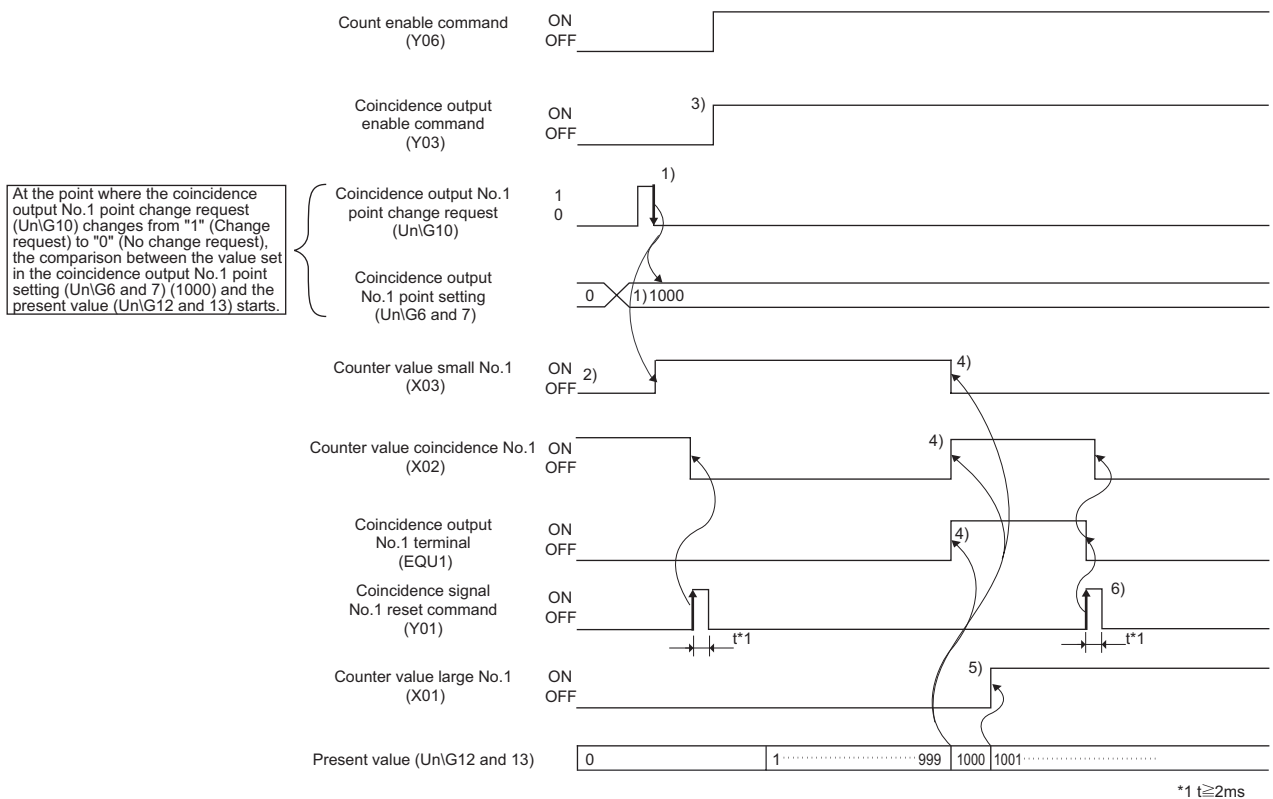
Figure 5.3 Operation example of the coincidence output function

Table 5.4 Details of operation example of the coincidence output function

Number	Description
1)[*1]	With the following procedures, start the coincidence detection using the value set in the coincidence output No.1 point setting (Un\G6 and 7). (1) Write "1000" for the coincidence output No.1 point setting (Un\G6 and 7). (2) Write "1" (Change request) for the coincidence output No.1 point change request (Un\G10). (3) The setting value becomes valid when "1" (Change requet) turns to "0" (No change request).
2)	When the present value (Un\G12 and 13) is smaller than the coincidence output No.1 point setting (Un\G6 and 7), the counter value small No.1 (X03) turns ON.
3)	When outputting from the coincidence output No.1 terminal (EQU1) of external device connector, turn ON the coincidence output enable command (Y03). At the time, the coincidence output No.2 terminal (EQU2) is also enabled.
4)	When the present value (Un\G12 and 13) is equal to the coincidence output No.1 point setting (Un\G6 and 7), the counter value small No.1 (X03) turns OFF and the counter value coincidence No.1 (X02) turns ON.
5)	When the present value (Un\G12 and 13) is larger than the coincidence output No.1 point setting (Un\G6 and 7), the counter value large No.1 (X01) turns ON. The counter value coincidence No.1 (X02) remains ON until resetting it.
6)	Turn ON the coincidence signal No.1 reset command (Y01) to reset the counter value coincidence No.1 (X02). If the counter value coincidence No.1 (X02) remains ON, the counter value coincidence No.1 (X02) cannot be output next time.

* 1 If the operation in 1) is not executed, comparison with the values stored in the coincidence output No.1 point setting (Un\G6 and 7) and the coincidence output No.2 point setting (Un\G8 and 9) is not executed.

⊠**POINT**

(1) At immediately after the power-on or resetting the programmable controller CPU, the relation of the present value and the coincidence output point setting is the following: "Present value = Coincidence output point setting = 0". Therefore, the counter value coincidence (X02, X05, X12, and X15) of channels that use the coincidence output function turns ON.
For channels that use the coincidence output function, always execute the following procedures from 1 to 3.
For the programming method of the following procedures, refer to Section 7.3 and Section 7.4.

Procedure 1:
Set the following buffer memories and make sure that the coincidence output point settings are other than "0"

Buffer memory address to be set	Setting value
CH1 coincidence output No.1 point setting (Un\G6 and 7)	Other than "0"
CH1 coincidence output No.2 point setting (Un\G8 and 9)	
CH2 coincidence output No.1 point setting (Un\G206 and 207)	
CH2 coincidence output No.2 point setting (Un\G208 and 209)	
CH1 coincidence output No.1 point change request (Un\G10)	1
CH1 coincidence output No.2 point change request (Un\G11)	
CH2 coincidence output No.1 point change request (Un\G210)	
CH2 coincidence output No.2 point change request (Un\G211)	

Procedure 2:
Turn from OFF to ON then OFF the following signals to turn OFF the counter value coincidence (X02, X05, X12, and X15).

Signals to be turned OFF → ON → OFF[*1]
CH1 coincidence signal No.1 reset command (Y01)
CH1 coincidence signal No.2 reset command (Y02)
CH2 coincidence signal No.1 reset command (Y11)
CH2 coincidence signal No.2 reset command (Y12)

*1 Make sure that ON time is longer than 2ms.

Procedure 3 (Only for external output):
After checking that the counter value coincidence (X02, X05, X12, and X15) is OFF, turn ON the coincidence output enable (Y03 and Y13).

(2) Even if the coincidence signal No.1 reset command (Y01) is turned from ON to OFF while the present value is equal to the coincidence output point setting, the counter value coincidence (X02) and the coincidence output No.1 terminal (EQU1) turn ON again.

(3) When the counter value coincidence No.1 (X02) is turned from OFF to ON by the coincidence detection process of the QD64D2, there may be cases where the counter value large No.1 (X01) or the counter value small No.1 (X03) turns ON.

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(2) Wiring check for the coincidence output No.1 terminal (EQU1) and the coincidence output No.2 terminal (EQU2)

For the coincidence output function, the wiring cannot be checked with the coincidence output test function (refer to Section 5.3.3).
Check the wiring referring to the following procedures.
Wiring check for the coincidence output No.1 terminal (EQU1) of channel 1 is indicated below.

1) Set the same value for the coincidence output No.1 point setting (Un\G6 and 7) and the present value (Un\G12 and 13).

2) Write "1" (Change request) for the coincidence output No.1 point change request (Un\G10).
If the setting is other than "1", the value after changing the coincidence output No.1 point setting (Un\G6 and 7) is not reflected, and the comparison is performed with the value before change.

3) Turn ON or OFF the coincidence output enable command (Y03).
Note that in the case where the coincidence output No.1 point setting (Un\G6 and 7) is equal to the coincidence output No.2 point setting (Un\G8 and 9), when the coincidence output enable command (Y03) is turned ON or OFF, the coincidence output No.2 terminal (EQU2) also turns ON.

5.3.2 Using the continuous comparison function

Each channel has No.1 and No.2 comparison points. Each point individually compares to the present value (Un\G12 and 13) and outputs the comparison result (refer to Table 5.5). 16 comparison points can be set for each No.1 and No.2.

Without rewriting the comparison point in the middle of the control, multiple coincidence detections can be executed easily.

Table 5.5 Continuous comparison function

Comparison point		Signal and external output terminal used to output the comparison result	
		Input signal (X)	External output
No.1	Continuous comparison No.1 point 1 setting (Un\G54 and 55) to Continuous comparison No.1 point 16 setting (Un\G84 and 85)	•Counter value large No.1 (X01) •Counter value coincidence No.1 (X02) •Counter value small No.1 (X03)	Coincidence output No.1 terminal (EQU1)
No.2	Continuous comparison No.2 point 1 setting (Un\G104 and 105) to Continuous comparison No.2 point 16 setting (Un\G134 and 135)	•Counter value large No.2 (X04) •Counter value coincidence No.2 (X05) •Counter value small No.2 (X06)	Coincidence output No.2 terminal (EQU2)

In this section, I/O numbers (X/Y) and buffer memory addresses are listed for channel 1 and continuous comparison No.1. For I/O numbers and buffer memory addresses used for channel 2 and continuous comparison No.2, refer to Section 3.3.1 and Section 3.4.1.

(1) Usage sequence of the continuous comparison No.1 point n setting (Un\G54 to 85) and the continuous comparison No.2 point n setting (Un\G104 to 135)

By the magnitude correlation of the following buffer memories, an order and range of the continuous comparison points as comparison targets can be specified.

A: Continuous comparison No.1 start point setting (Un\G50)

B: Continuous comparison No.1 repeat point setting (Un\G51)

(a) When A < B
Example: A = 5, B = 10

5 → 6 → 7 → 8 → 9 → 10
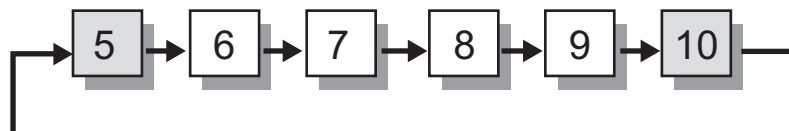
(b) When A > B
Example: A = 10, B = 3

10 → 11 → 12 .... 16 → 1 → 2 → 3
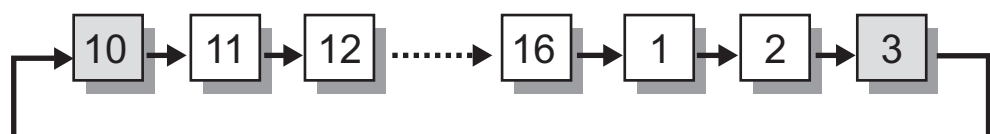
(c) When A = B
    Example: A = 5, B = 5
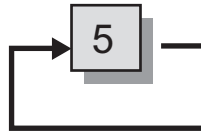
After coincidence detection with the continuous comparison No.1 point 16 setting (Un\G84 and 85) is completed, the comparison target returns to the continuous comparison No.1 point 1 setting (Un\G54 and 55) again.
When temporarily stopping the continuous comparison, turn OFF the count enable command (Y06) and so on, so that the present value (Un\G12 and 13) does not change.

☒POINT

When restarting the continuous comparison function after stopping the function, the comparison starts from the point set by the continuous comparison No.1 start point setting (Un\G50).

(2) Operation of the continuous comparison function
Setting example for comparing between point 1 (1000) and point 2 (21000) repeatedly using the continuous comparison No.1 is indicated below.

(a) Initial setting
Write the following values beforehand. *1
Continuous comparison No.1 start point setting (Un\G50) = 1
Continuous comparison No.1 repeat point setting (Un\G51) = 2
Continuous comparison No.1 ON time setting (Un\G52) = 1ms
Continuous comparison No.1 point 1 setting (Un\G54 and 55) = 1000
Continuous comparison No.1 point 2 setting (Un\G56 and 57) = 21000

* 1 The continuous comparison point can be set up to 16 points each. Beforehand, set all points to be used. (Refer to Section 3.4.1)
If the settings of buffer memories for the continuous comparison No.1 start point setting (Un\G50) and so on are improper, an error (Error code 201 to 222) occurs and the continuous comparison cannot be started.

(b) Operation diagram

*1 t1 = Continuous comparison No.1 ON time setting (Un\G52)
*2 t1<t2< (t1+1ms)
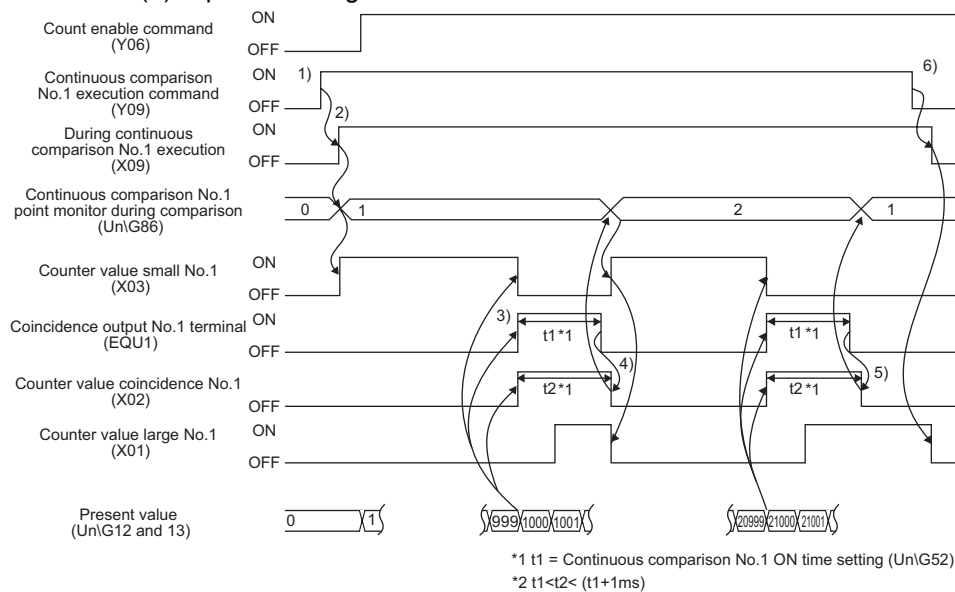
Figure 5.4 Operation example of the continuous comparison function

Table 5.6 Details of operation example of the continuous comparison function

Number	Description
1)	[Execution request] Turn ON the continuous comparison No.1 execution command (Y09).
2)	[Continuous comparison start] When the continuous comparison is ready, first comparison target will be the continuous comparison No.1 point 1 setting (Un\G54 and 55) because "1" is set in the continuous comparison No.1 start point setting (Un\G50). When "1" is stored in the continuous comparison No.1 point monitor during comparison (Un\G86), the during continuous comparison No.1 execution (X09) turns ON and the continuous comparison starts.
3)	[At counter value coincidence] When the present value (Un\G12 and 13) is equal to the continuous comparison No.1 point 1 setting, the following are processed. 1) The counter value small No.1 (X03) turns OFF and the counter value coincidence No.1 (X02) and the coincidence output No.1 terminal (EQU1) turn ON. 2) A coincidence detection interrupt to the programmable controller CPU is generated.
4)	[Process after the continuous comparison ON time setting] After a set time of the continuous comparison No.1 ON time setting (Un\G52) elapses, the coincidence output No.1 terminal (EQU1) turns OFF. •Comparison target will be the continuous comparison No.1 point 2 setting (Un\G56 and 57). •"2" is stored in the continuous comparison No.1 point monitor during comparison (Un\G86). •The counter value coincidence No.1 (X02) turns OFF.
5)	When OFF of the coincidence output No.1 terminal (EQU1) is detected, the following are processed. (After that, the comparison is repeated with the continuous comparison No.1 point 2 setting (Un\G56 and 57) and the continuous comparison No.1 point 1 setting (Un\G54 and 55) until the continuous comparison No.1 execution command (Y09) is turned OFF.) •Comparison target will be the continuous comparison No.1 point 1 setting (Un\G54 and 55). •"1" is stored in the continuous comparison No.1 point monitor during comparison (Un\G86). •The counter value coincidence No.1 (X02) turns OFF.
6)	[Complete process] When the coninuous comparison No.1 execution command (Y09) is turned OFF, the following are processed and the during continuous comparison No.1 execution (X09) turns OFF. •The counter value small No.1 (X03) turns OFF. •The counter value coincidence No.1 (X02) turns OFF. •The counter value large No.1 (X01) turns OFF. The continuous comparison No.1 point monitor during comparison (Un\G86) is held until the during continuous comparison No.1 execution (X09) turns ON.

⊠ POINT

(1) When the count value coincides with the comparison point, an external output is performed. Therefore, do not connect anything to the unused coincidence output terminal (EQU).

(2) When the counter value coincidence No.1 (X02) is turned from OFF to ON by the coincidence detection process of the QD64D2, there may be cases where the counter value large No.1 (X01) or the counter value small No.1 (X03) turns ON.

(3) If the continuous comparison No.1 execution command (Y09) is turned OFF while outputting from the coincidence output No.1 terminal (EQU1), the output stops regardless of the set time of the continuous comparison No.1 ON time setting (Un\G52).

(3) When comparing with 17 points or more of the continuous comparison point setting

For the QD64D2, settable continuous comparison No.1 point n setting (Un\G54 to 85) is up to 16 points each. Therefore, when comparing with 17 points or more, execute the following procedures.

(a) Initial setting

Set the following and turn from OFF to ON the continuous comparison No.1 execution command (Y09).

- Continuous comparison No.1 start point setting (Un\G50) = 1 [*1]
- Continuous comparison No.1 repeat point setting (Un\G51) = 16 [*1]
- Set the continuous comparison points for point 1 through point 16 in the following buffer memories.
  Continuous comparison No.1 point 1 setting (Un\G54 and 55) to
  Continuous comparison No.1 point 16 setting (Un\G84 and 85)

* 1 When starting from point 2 or later, set a value that is "Start point setting -1" for the repeat point setting.
Example) When start point = 6, repeat point = 5
When starting from point 16, set the following.
Start point = 16, Repeat point = 1

(b) Rewriting data during comparison

Set the following when the continuous comparison No.1 point monitor during comparison (Un\G86) becomes "2".

- Continuous comparison No.1 point setting (Un\G54 and 55) = Continuous comparison point setting for the 17th point

After that, rewrite the data at every point change.
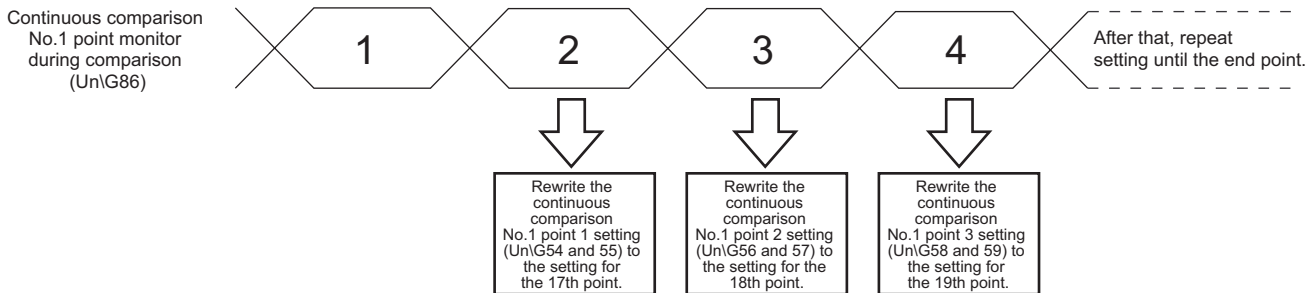
Figure 5.5 Rewriting data during comparison

When the point monitor is "1", rewrite the point 16 setting.
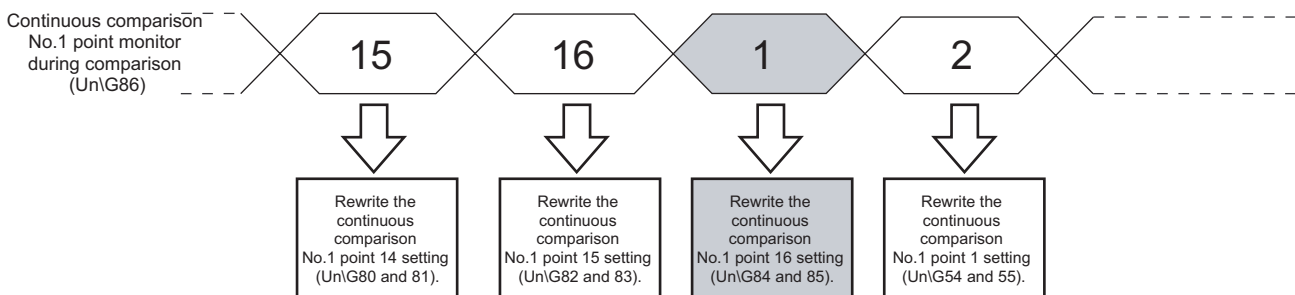
Figure 5.6 When the point monitor is "1"

(c) Process after completion of comparison at end point

1) When repeatedly comparing from the 1st point
Set the following after setting all continuous comparison point settings for the 17th point and later.

   • Continuous comparison No.1 point n setting (Un\G54 to 85) of (Continuous comparison No.1 point monitor during comparison (Un\G86) -1) = Continuous comparison point setting of the 1st point and later

Figure 5.7 is the example when comparing with 19 points.
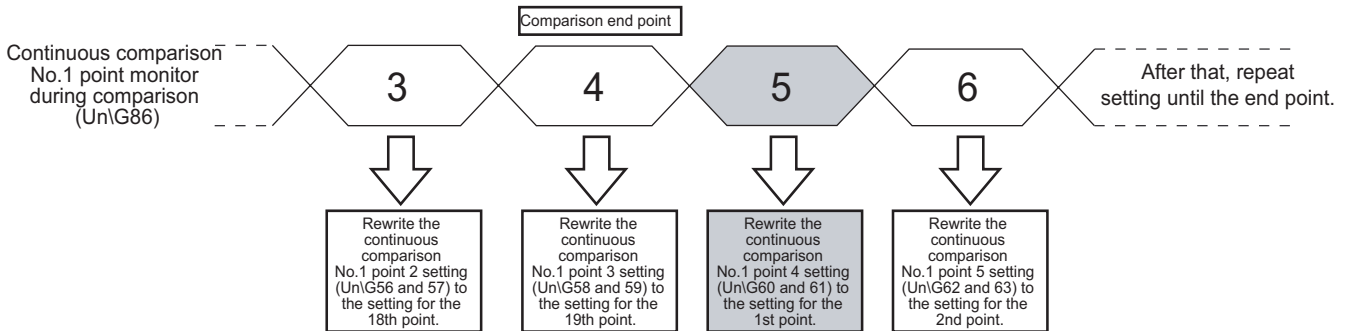
Figure 5.7 When repeatedly comparing from the 1st point

2) When stopping the continuous comparison
Turn from ON to OFF the continuous comparison No.1 execution command (Y09) under the following condition.

   • (Continuous comparison No.1 point monitor during comparison (Un\G86) -1) = Comparison end point

Figure 5.8 is the example when comparing with 19 points.
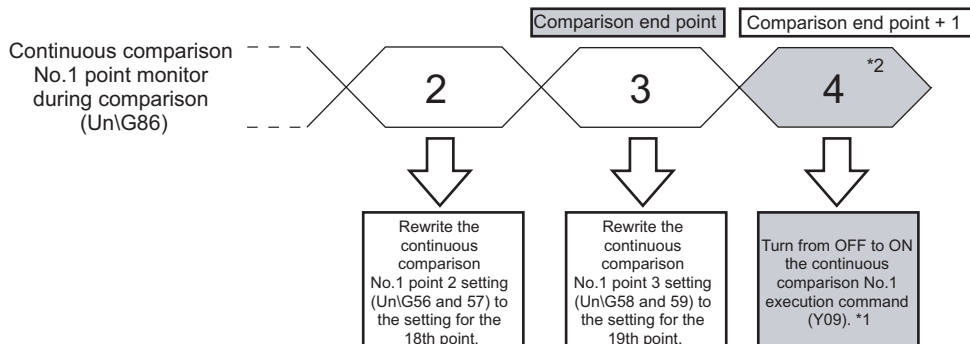
*1 When the present value may coincide with the comparison point of the (comparison end point + 1) before stopping the continuous comparison, store a value which does not perform a coincidence output (for example: -1) to the (comparison end point + 1) before completing the coincidence detection at the comparison end point.
*2 In the case of the comparison end point is 16, turn from ON to OFF the execution command when the point monitor changes to 1.

Figure 5.8 When stopping the continuous comparison

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Table 5.7 shows the example of continuous comparison point setting for 19 points.

Table 5.7 Example of continuous comparison point setting

Continuous comparison order	Continuous comparison point setting	Target continuous comparison No.1 point n setting
1	100	Continuous comparison No.1 point 1 setting
2	110	Continuous comparison No.1 point 2 setting
3	120	Continuous comparison No.1 point 3 setting
4	130	Continuous comparison No.1 point 4 setting
5	140	Continuous comparison No.1 point 5 setting
6	150	Continuous comparison No.1 point 6 setting
7	160	Continuous comparison No.1 point 7 setting
8	170	Continuous comparison No.1 point 8 setting
9	180	Continuous comparison No.1 point 9 setting
10	190	Continuous comparison No.1 point 10 setting
11	200	Continuous comparison No.1 point 11 setting
12	210	Continuous comparison No.1 point 12 setting
13	220	Continuous comparison No.1 point 13 setting
14	230	Continuous comparison No.1 point 14 setting
15	240	Continuous comparison No.1 point 15 setting
16	250	Continuous comparison No.1 point 16 setting
17	260	Continuous comparison No.1 point 1 setting
18	270	Continuous comparison No.1 point 2 setting
19	280	Continuous comparison No.1 point 3 setting
----	-1	Continuous comparison No.1 point 4 setting (Set "-1" so that the coincidence output is not performed when the continuous comparison function is stopped.)

(4) Continuous comparison No.m point n setting interval

For the interval of the continuous comparison No.m point n setting, set the values to satisfy the following conditions 1 and 2.

(a) Condition 1:

$$\text{Interval of (Continuous comparison No.m point n setting)} \geqq \left(\text{(Continuous comparison No.m ON time setting [ms])} + 1[\text{ms}] \right) \times \frac{\text{Input pulse speed [pps]}}{1000}$$

(b) Condition 2 (Applies only when the derating of external coincidence output is less than 100% (Refer to Section 3.1.2)):

$$\text{Interval of (Continuous comparison No.m point n setting)} \geqq \left(\text{Continuous comparison No.m ON time setting [ms]} \times \frac{100[\%]}{\text{ON ratio [\%]}} \right) \times \frac{\text{Input pulse speed [pps]}}{1000}$$

For example, when "Continuous comparison No.1 ON time setting" = 10[ms], "ON ratio" = 50[%], "Input pulse speed" = 4[Mpps] = 4000000[pps], interval of the continuous comparison No.1 point n setting (Un\G54 to 85) is the following.

Condition 1:

$$\text{Interval of (Continuous comparison No.1 point n setting (Un\G54 to 85))} \geqq \left(10[\text{ms}] + 1[\text{ms}] \right) \times \frac{4000000[\text{pps}]}{1000}$$

$$\geqq 44000$$

Condition 2:

$$\text{Interval of (Continuous comparison No.1 point n setting (Un\G54 to 85))} \geqq \left(10[\text{ms}] \times \frac{100[\%]}{50[\%]} \right) \times \frac{4000000[\text{pps}]}{1000}$$

$$\geqq 80000$$

↓ (To satisfy the conditions 1 and 2, set the value of condition 2.)

Interval of the continuous comparison No.1 point n setting (Un\G54 to 85) $\geqq$ 80000

⊠POINT

"1ms" in the above condition 1 is a time for the comparison target change in the QD64D2. Always set the sequence program to satisfy the condition 1.
When the count value is coincided within the time, the QD64D2 may not detect the coincidence depending on the timing of the count value coincidence and the comparison target change.

5.3.3 Using the coincidence output test function

Use the coincidence output test function to check the wiring of the coincidence output No.1 terminal (EQU1) and the coincidence output No.2 terminal (EQU2) when selecting the continuous comparison function.

When using the continuous comparison function, the coincidence output No.1 terminal (EQU1) and the coincidence output No.2 terminal (EQU2) automatically turn OFF. Therefore, check the wiring using the coincidence output test function.

(1) Operation of coincidence output test function
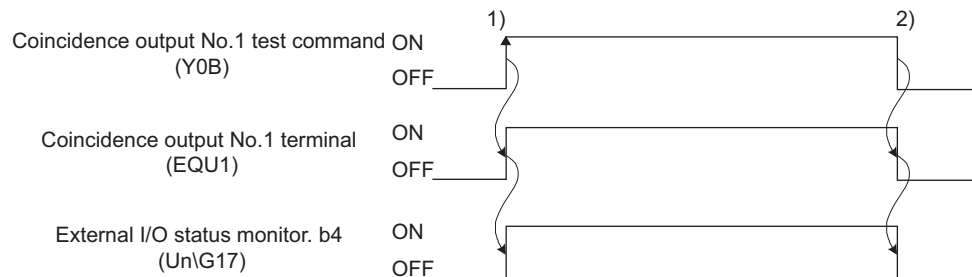
Figure 5.9 Operation example of the coincidence output test function

Table 5.8 Details of operation example of coincidence output test function

Number	Description
1)	When the coincidence output No.1 test command (Y0B) is turned ON, the following are executed. •The coincidence output No.1 terminal (EQU1) turns ON. •Bit 4 (Coincidence output No.1 output status) of the external I/O status monitor (Un\G17) turns ON.
2)	When the coincidence output No.1 test command (Y0B) is turned OFF, the following are executed. •The coincidence output No.1 terminal (EQU1) turns OFF. •Bit 4 (Coincidence output No.1 output status) of the external I/O status monitor (Un\G17) turns OFF.

(2) Execution condition of the coincidence output test function

(a) Before executing the coincidence output test function, check that the following signals are all OFF.
- Count enable command (Y06)
- Continuous comparison No.1 execution command (Y09)
- During continuous comparison No.1 execution (X09)
- Continuous comparison No.2 execution command (Y0A)
- During continuous comparison No.2 execution (X0A)

If the coincidence output test is attempted while any of the above signal is ON, the coincidence output No.m test output not possible warning (Warning code: 31 and 32) occurs.

(b) Counting cannot be started while the coincidence output test command is ON. Do not turn ON the count enable command (Y06).
If it is turned ON, a count enable execution not possible error (Error code: 300) occurs.

(c) Do not turn ON the continuous comparison execution command while the coincidence output test command is ON.
If the continuous comparison execution command is turned ON while the test command is ON, a continuous comparison No.m execution not possible error (Error code: 311 and 312) occurs.

⊠**POINT**

- Even if the coincidence output No.1 test command (Y0B) and the coincidence output No.2 test command (Y0C) are turned ON, the counter value coincidence No.1 (X02) and the counter value coincidence No.2 (X05) do not turn ON/OFF. (Coincidence detection interrupt also does not occur.)
- The coincidence output test function cannot be used when selecting the coincidence output function.

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5.3.4 Coincidence detection interrupt function

Use the coincidence detection interrupt function to request an interrupt to the programmable controller CPU when a coincidence is detected, and start up the interrupt program.

(a) Up to 16-point interrupt factors (SI) are allowed for a single MELSEC-Q series intelligent function module.
As shown in Table 5.9, the QD64D2 has 4-point interrupt factors (SI) for coincidence detection.

Table 5.9 List of interrupt factors

SI No.	Interrupt factor
0	Channel 1: Coincidence detection of coincidence output No.1 point setting or continuous comparison No.1 point m setting
1	Channel 1: Coincidence detection of coincidence output No.2 point setting or continuous comparison No.2 point m setting
2	Channel 2: Coincidence detection of coincidence output No.1 point setting or continuous comparison No.1 point m setting
3	Channel 2: Coincidence detection of coincidence output No.2 point setting or continuous comparison No.2 point m setting
4 to 15	Reserved

*1 The coincidence signal No.1 reset command (Y01) is only used for the coincidence output function.
For the continuous comparison function, the counter value coincidence No.1 (X02) automatically turns OFF after elapsing the set time of the continuous comparison No.1 ON time setting (Un\G52).

Figure 5.10 Timing of interrupt signal generation

(b) It takes approximately 150μs from when the QD64D2 detects a coincidence until it requests an interrupt to the programmable controller CPU.

(c) Select [PLC parameter] - [PLC system] - [Intelligent function module setting] - [Interrupt pointer settings] to set the interrupt factors (SI) of the QD64D2 and interrupt pointers of the programmable controller CPU.

1) [PLC side] [Interrupt pointer start No.]
Set the start interrupt pointer number of the programmable controller CPU.
Setting range: 50 to 255

2) [PLC side] [Interrupt pointer No. of module]
   Set the number of interrupt factors (SI).
   Setting range: 1 to 4

3) [Intelli. module side] [Start I/O No.]
   Set the start I/O number of the QD64D2.
   Setting range: 0000 to 0FE0(H)

4) [Intelli. module side] [Start SI No.]
   Set the start interrupt factor (SI) of the QD64D2.
   Setting range: 0 to 3

The following shows a setting example where SI 0 to 3 of the QD64D2 in the slot of start I/O No.20 are assigned to interrupt pointers I50 to I53.
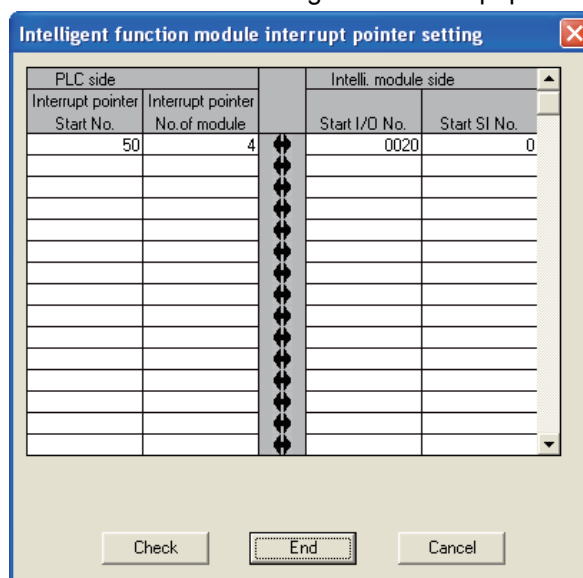
Figure 5.11 Interrupt pointer setting example (GX Developer screen)

(d) The following two methods are available for using particular SI numbers only.

1) Using the interrupt pointer setting with parameters
   According to the setting in the [Intelligent function module interrupt pointer setting] dialog box, only the interrupt factors starting from the [Start SI No.] and equivalent to the number set at [Interrupt pointer No. of module] are used.
   For example, if the [Start SI No.] and [Interrupt pointer No. of module] are set to 1 and 2 respectively, only SI 1 and 2 will be used.
   The interrupt function is not used if the interrupt pointer setting with parameters has not been made.

2) Using the IMASK instruction from the sequence program
   With the IMASK instruction, whether to enable or disable (interrupt mask) the interrupt program execution can be set to each interrupt pointer number.
   For details of the IMASK instruction, refer to the following manual.

   ☞ MELSEC-Q/L Programming Manual (Common Instruction)

⊠**POINT**

- Coincidence detection interrupt occurs at the rising edge (OFF → ON) of the counter value coincidence No.1 (X02) or the counter value coincidence No.2 (X05). Therefore, next interrupt request does not occur unless the counter value coincidence No.1 (X02) and the counter value coincidence No.2 (X05) are reset and turned OFF.
- When using the coincidence output function, the counter value coincidence No.1 (X02) and the counter value coincidence No.2 (X05) turns ON immediately after the power-on or resetting the programmable controller CPU; however, a coincidence detection interrupt does not occur.

  For resetting method of the counter value coincidence No.1 (X02) and the counter value coincidence No.2 (X05), refer to Section 5.3.1.

5.4 Using the Preset Function

Use the preset function to rewrite the present value (Un\G12 and 13) to any value (preset value) and start counting pulses from the value.

The following two methods are available for presetting.
- Turn ON the preset command (Y04) by the sequence program.
- Turn ON the preset input terminal (PRST) of external input.

In (1) and (2) below, I/O numbers (X/Y) and buffer memory addresses are listed for channel 1. For I/O numbers and buffer memory addresses used for channel 2 , refer to Section 3.3.1 and Section 3.4.1.

(1) Operation when turning ON the preset command (Y04) by the sequence program

Turn ON the preset command (Y04) by the sequence program to execute preset.
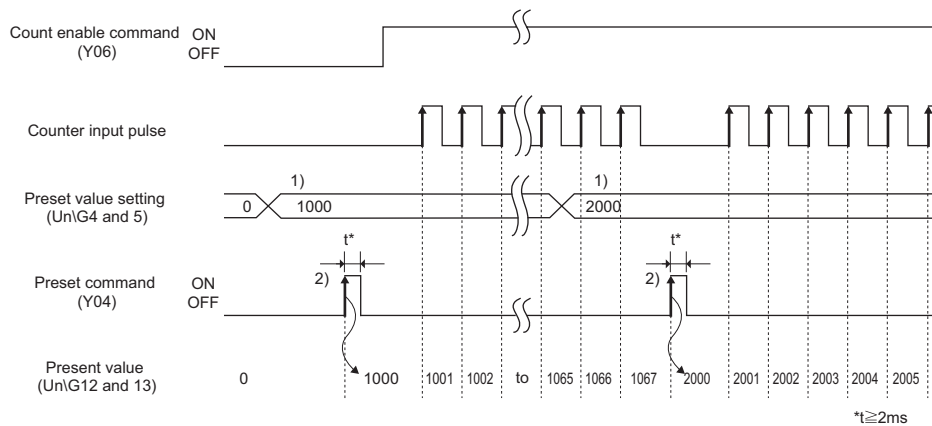
Figure 5.12 Operation example of the preset function by the sequence program

Table 5.10 Details of operation example of the preset function by the sequence program

Number	Description
1)	Write any value in the preset value setting (Un\G4 and 5) of the QD64D2 in 32-bit binary format.
2)	At the rising edge (OFF → ON) of the preset command (Y04), the preset value setting (Un\G4 and 5) is stored in the present value (Un\G12 and 13). The preset can be executed regardless of the ON/OFF status of the count enable command (Y06).

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(2) Operation when presetting by the external control signal

Apply ON voltage to the preset input terminal (PRST) for external input to execute preset. Operation example is indicated in Figure 5.13.
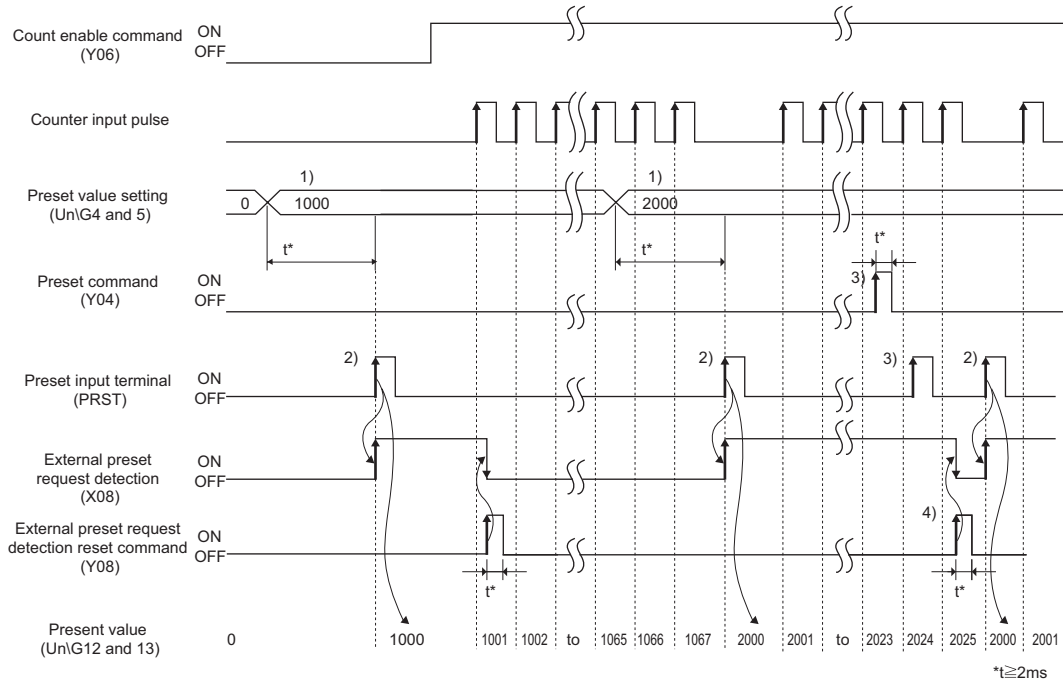
Figure 5.13 Operation example of the preset function by external control signal

Table 5.11 Details of operation example of the preset function by external control signal

Number	Description
1)	Write any value in the preset value setting (Un\G4 and 5) of the QD64D2 in 32-bit binary format.
2)	When the preset input terminal (PRST) is turned from OFF to ON, the preset value setting (Un\G4 and 5) is stored in the present value (Un\G12 and 13). The preset can be executed regardless of ON/OFF status of the count enable command (Y06).
3)	While the external preset request detection (X08) is ON, the preset cannot be executed by turning ON the preset command (Y04) or the preset input terminal (PRST).
4)	When the external preset request detection reset command (Y08) is turned ON and the external preset request detection (X08) turns OFF, the preset can be executed.

☒ **POINT**

When the external preset request detection (X08) is OFF, both the preset command (Y04) and the preset input terminal (PRST) are valid.

5.5 Using the Latch Counter Function

The latch counter function latches the present value (Un\G12 and 13) to the latch count value (Un\G14 and 15).

The following two methods are available for latch operation.
- Turn ON the latch counter execution command (Y07) by the sequence program.
- Turn ON the latch counter input terminal (LATCH) of external input.

In (1) below, I/O numbers (X/Y) and buffer memory addresses are listed for channel 1. For I/O numbers and buffer memory addresses used for channel 2 , refer to Section 3.3.1 and Section 3.4.1.

(1) Operation of the latch counter function
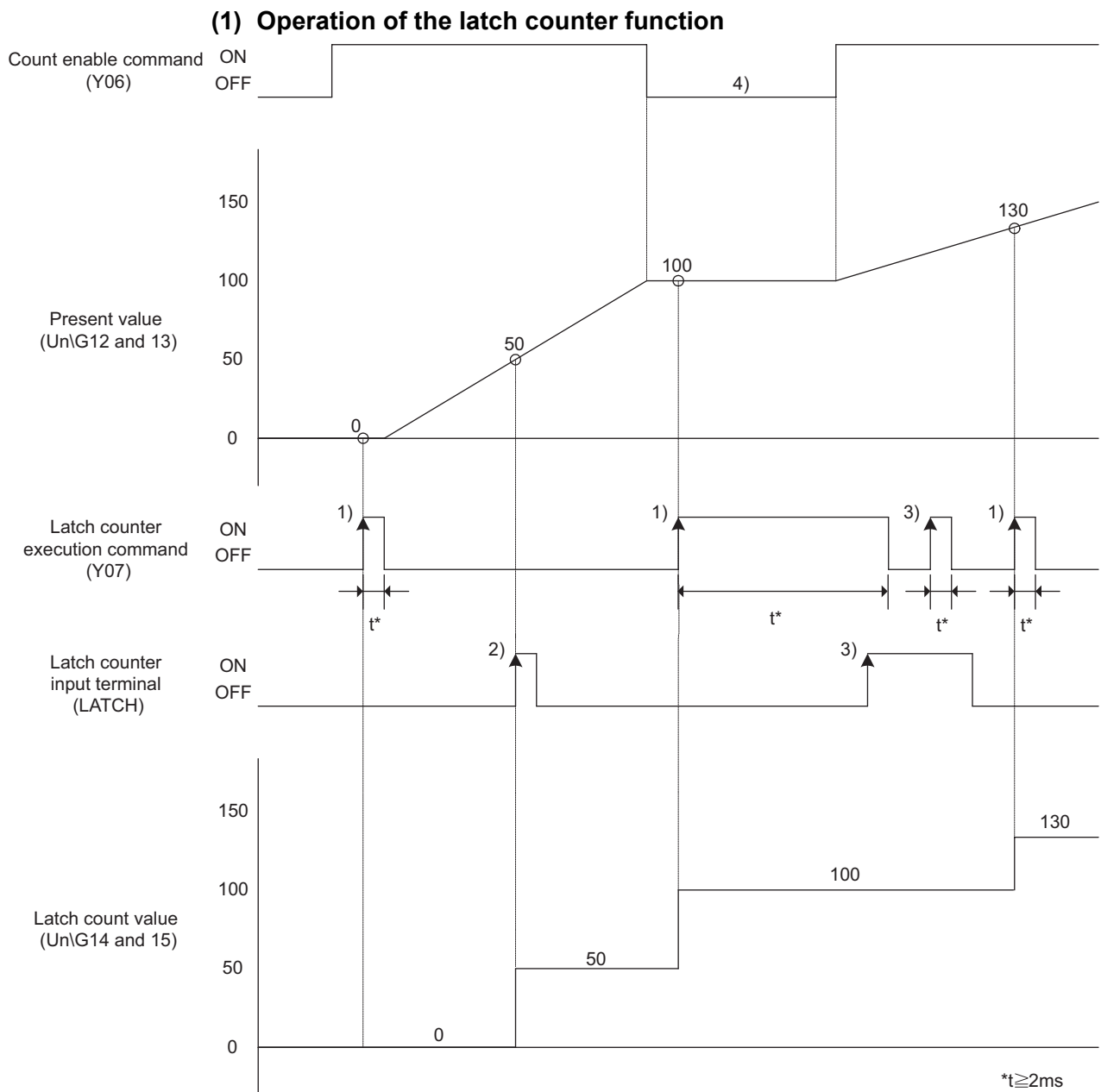
Figure 5.14 Operation example of the latch counter function

Table 5.12 Details of operation example of the latch counter function

Number	Description
1)	When the latch counter execution command (Y07) is turned from OFF to ON, the present value (Un\G12 and 13) is stored in the latch count value (Un\G14 and 15).
2)	When the latch counter input terminal (LATCH) is turned from OFF to ON, the present value (Un\G12 and 13) is stored in the latch count value (Un\G14 and 15).
3)	While the latch counter execution command (Y07) or the latch counter input terminal (LATCH) is ON, the latch counter function cannot be executed.
4)	The latch counter function can be executed regardless of ON/OFF status of the count enable command (Y06).

5.6 Response Delay Time

In the QD64D2, a response delays due to the cause indicated in (a) and (b) below.

(a) Scan time of the sequence program
It affects the delay of I/O signal.
Use the direct access input (DX) or the direct access output (DY) to minimize the delay.

(b) Control cycle (1ms) of the QD64D2
Up to 2ms (1 control cycle × 2) of delay occurs until the QD64D2 reads out the output signal and buffer memory updated by the sequence program and completes processing.
Update timing of the I/O signal and buffer memory varies within the range of a control cycle.

For example, the following is the maximum delay time until the QD64D2 executes the latch counter function and updates the latch count value after the latch counter execution command (Y07) is turned ON by the sequence program.

$$\text{Maximum delay time [ms]} = [\text{Time of (a)}] + [\text{Maximum time of (b)}]$$
$$= \text{Sequence program scan time} + 2 \text{ [ms]}$$

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CHAPTER6 UTILITY PACKAGE (GX Configurator-CT)

6.1   Utility Package Functions

Table 6.1 shows the functions of the utility package.

Table 6.1 Utility package (GX Configurator-CT) functions list

Function	Description	Reference
Initial setting	(1) Make the initial settings for each channel to operate the QD64D2. Set the values of the items where initial settings are required. • CH☐ Ring counter lower limit • CH☐ Ring counter upper limit • CH☐ Preset value setting • CH☐ Coincidence output No.1 point setting • CH☐ Coincidence output No.2 point setting • CH☐ Coincidence output No.1 point change request • CH☐ Coincidence output No.2 point change request • CH☐ Continuous comparison No.1 start point setting • CH☐ Continuous comparison No.1 repeat point setting • CH☐ Continuous comparison No.1 ON time setting • CH☐ Continuous comparison No.1 point n setting (n: 1 to 16) • CH☐ Continuous comparison No.2 start point setting • CH☐ Continuous comparison No.2 repeat point setting • CH☐ Continuous comparison No.2 ON time setting • CH☐ Continuous comparison No.2 point n setting (n: 1 to 16) (2) Data with initial settings are registered to programmable controller CPU parameters and are automatically written to the QD64D2 when the programmable controller CPU is in RUN.	Section 6.4
Auto refresh	(1) Set the buffer memory of the QD64D2 to which auto refresh is to be performed for each channel. • CH☐ Present value • CH☐ Latch count value • CH☐ Overflow detection flag • CH☐ External I/O status monitor • CH☐ Error code • CH☐ Warning code • CH☐ Continuous comparison No.1 point monitor during comparison • CH☐ Continuous comparison No.2 point monitor during comparison (2) The values stored in the QD64D2 buffer memory with auto refresh setting are automatically read when the programmable controller CPU executes the END instruction.	Section 6.5

Table 6.1 Utility package (GX Configurator-CT) functions list

Function	Description	Reference
Monitor/Test	(1) Monitors/tests the following buffer memories and I/O signals of the QD64D2. • Y device • CH☐ Ring counter lower limit • CH☐ Ring counter upper limit • CH☐ Preset value setting • CH☐ Coincidence output No.1 point setting • CH☐ Coincidence output No.2 point setting • CH☐ Coincidence output No.1 point change request • CH☐ Coincidence output No.2 point change request • CH☐ Continuous comparison No.1 start point setting • CH☐ Continuous comparison No.1 repeat point setting • CH☐ Continuous comparison No.1 ON time setting • CH☐ Continuous comparison No.1 point n setting (n: 1 to 16) • CH☐ Continuous comparison No.2 start point setting • CH☐ Continuous comparison No.2 repeat point setting • CH☐ Continuous comparison No.2 ON time setting • CH☐ Continuous comparison No.2 point n setting (n: 1 to 16) (2) Monitors the following buffer memories of the QD64D2. • X device • CH☐ Present value • CH☐ Latch count value • CH☐ Overflow detection flag • CH☐ External I/O status monitor • CH☐ Error code • CH☐ Warning code • CH☐ Continuous comparison No.1 point monitor during comparison • CH☐ Continuous comparison No.2 point monitor during comparison	Section 6.6

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6.2 Installing and Uninstalling the Utility Package

For how to install or uninstall the utility package, refer to "Method of installing the MELSOFT Series" included in the utility package.

6.2.1 Handling precautions

The following explains the precautions on using the utility package.

(1) For safety
Since the utility is add-in software for GX Developer, read "SAFETY PRECAUTIONS" and the basic operating procedures in the GX Developer Operating Manual.

(2) About installation
GX Configurator-CT is add-in software for GX Developer Version 4 or later.
Therefore, GX Configurator-CT must be installed on the personal computer that has already GX Developer Version 4 or later installed.

(3) Screen error of [Intelligent function module utility]
Insufficient system resource may cause the screen to be displayed inappropriately while using the Intelligent function module utility.
If this occurs, close the Intelligent function module utility, GX Developer (program, comments, etc.), and other applications, and then start GX Developer and Intelligent function module utility again.

(4) To start the [Intelligent function module utility]

(a) In GX Developer, select "QCPU (Q mode)" for [PLC series] and specify a project. If any other than "QCPU (Q mode)" is selected for [PLC series], or if no project is specified, the [Intelligent function module utility] will not start.

(b) Multiple [Intelligent function module utility] can be started.
However, [Open parameters] and [Save parameters] operations under [Intelligent function module parameter] are allowed for one [Intelligent function module utility] only. Only the [Monitor/test] operation is allowed for the other utilities.

(5) Switching between two or more Intelligent function module utilities
When two or more Intelligent function module utility screens cannot be displayed side by side, select a screen to be displayed on the top of others using the task bar.

(6) Number of parameters that can be set in GX Configurator-CT
When multiple intelligent function modules are mounted, set the parameters within the maximum number of settable parameters shown on the next page.

Table 6.2 Maximum number of settable parameters using GX Configurator

When intelligent function modules are mounted to:	Maximum number of parameter settings	
	Initial setting	Auto refresh setting
Q00J/Q00/Q01CPU	512	256
Q02/Q02H/Q06H/Q12H/Q25HCPU	512	256
Q02PH/Q06PH/Q12PH/Q25PHCPU	512	256
Q12PRH/Q25PRHCPU	512	256
Q00UJ/Q00U/Q01UCPU	512	256
Q02UCPU	2048	1024
Q03UD/Q04UDH/Q06UDH/Q10UDH/ Q13UDH/Q20UDH/Q26UDH/ Q03UDE/Q04UDEH/Q06UDEH/ Q10UDEH/Q13UDEH/Q20UDEH/ Q26UDEHCPU	4096	2048
Q50UDEH/Q100UDEHCPU	Use prohibited	Use prohibited
MELSECNET/H remote I/O station	512	256

For example, if multiple intelligent function modules are mounted to the remote I/O station, configure the settings in GX Configurator so that the number of parameters set for all the intelligent function modules does not exceed the limit of the remote I/O station. Calculate the total number of parameter settings separately for the initial setting and for the auto refresh setting.

The number of parameters that can be set for one module in GX Configurator-CT is as shown below.

Table 6.3 Number of settable parameters per module

Target module	Initial setting	Auto refresh setting
QD64D2	6 (fixed)	16 (Max.)

Example) Counting the number of parameter settings in Auto refresh setting
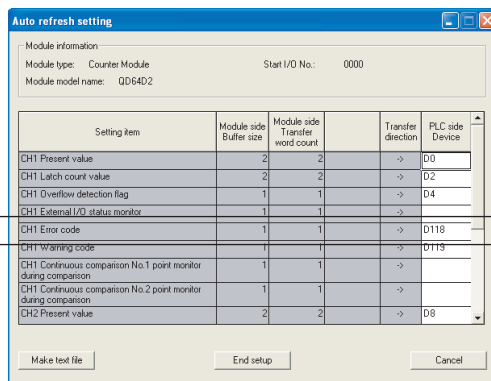
This one row is counted as one setting.
Blank rows are not counted.
Count up all the setting items on this screen, and add the total to the number of settings for other intelligent function modules to get a grand total.

Figure 6.1 Numeration for the number of parameters set in Auto refresh setting

6.2.2 Operating environment

This section explains the operating environment of the personal computer that runs GX Configurator-CT.

Table 6.4 Operating environment of the personal computer

Item		Description
Installation (Add-in) target[*1]		Add-in to GX Developer Version 4 (English version) or later.[*2]
Computer		Windows®-based personal computer
	CPU	Refer to Table 6.5 "Operating system and performance required for personal computer".
	Required memory	
Hard disk space[*3]	For installation	65 MB or more
	For operation	10 MB or more
Display		800 × 600 dots or more resolution[*4]
Basic software		Microsoft® Windows® 95 Operating System (English version)
		Microsoft® Windows® 98 Operating System (English version)
		Microsoft® Windows® Millennium Edition Operating System (English version)
		Microsoft® Windows NT® Workstation Operating System Version 4.0 (English version)
		Microsoft® Windows® 2000 Professional Operating System (English version)
		Microsoft® Windows® XP Professional Operating System (English version)
		Microsoft® Windows® XP Home Edition Operating System (English version)
		Microsoft® Windows Vista® Home Basic Operating System (English version)
		Microsoft® Windows Vista® Home Premium Operating System (English version)
		Microsoft® Windows Vista® Business Operating System (English version)
		Microsoft® Windows Vista® Ultimate Operating System (English version)
		Microsoft® Windows Vista® Enterprise Operating System (English version)

* 1 Install GX Configurator-CT in GX Developer Version 4 or higher in the same language.
  GX Developer (English version) and GX Configurator-CT (Japanese version) cannot be used in combination, and GX Developer (Japanese version) and GX Configurator-CT (English version) cannot be used in combination.

* 2 GX Configurator-CT is not applicable to GX Developer Version 3 or earlier.

* 3 At least 15GB is required for Windows Vista®.

* 4 Resolution of 1024 X 768 dots or more is recommended for Windows Vista®.

Table 6.5 Operating system and performance required for personal computer

Operating system	Performance required for personal computer	
	CPU	Memory
Windows® 95	Pentium® 133 MHz or more	32 MB or more
Windows® 98	Pentium® 133 MHz or more	32 MB or more
Windows® Me	Pentium® 150 MHz or more	32 MB or more
Windows NT® Workstation 4.0	Pentium® 133 MHz or more	32 MB or more
Windows® 2000 Professional	Pentium® 133 MHz or more	64 MB or more
Windows® XP Professional (Service Pack1 or later)	Pentium® 300 MHz or more	128 MB or more
Windows® XP Home Edition (Service Pack1 or later)	Pentium® 300 MHz or more	128 MB or more
Windows Vista® Home Basic	Pentium® 1GHz or more	1GB or more
Windows Vista® Home Premium	Pentium® 1GHz or more	1GB or more
Windows Vista® Business	Pentium® 1GHz or more	1GB or more
Windows Vista® Ultimate	Pentium® 1GHz or more	1GB or more
Windows Vista® Enterprise	Pentium® 1GHz or more	1GB or more

⊠POINT

(1) The functions shown below are not available for Windows® XP and Windows Vista®.
If any of the following functions is attempted, this product may not operate normally.
- Start of application in Windows compatible mode
- Fast user switching
- Remote desktop
- Large fonts (Details setting of Display Properties)

Also, 64-bit version Windows® XP and Windows Vista® are not supported.

(2) Use a USER authorization or higher in Windows Vista®.

6.3 Utility Package Operation

6.3.1 Common utility package operations

(1) Control keys

Table 6.6 shows the special keys that can be used in operations of the utility package and their applications.

Table 6.6 Control keys

Key	Application
ESC	Cancels the current entry in a cell. Closes the window.
Tab	Moves between controls in the window.
Ctrl	Used in combination with the mouse operation to select multiple cells for test execution.
Delete	Deletes the character where the cursor is positioned. When a cell is selected, clears all of the setting contents in the cell.
Back Space	Deletes the character where the cursor is positioned.
↑ ↓ ← →	Moves the cursor.
Page Up	Moves the cursor one page up.
Page Down	Moves the cursor one page down.
Enter	Completes the entry in the cell.

(2) Data created with the utility package

The following data or files that are created with the utility package can be also handled in GX Developer. Figure 6.3 shows respective data or files are handled in which operation.

(3) Intelligent function module parameter

(a) This represents the data created in Auto refresh setting, and they are stored in an intelligent function module parameter file in a project created by GX Developer.

```
Project
   ├─Program
   ├─Parameter
          ├── PLC parameter
          ├── Network parameter
          └── Intelligent function module parameter
```
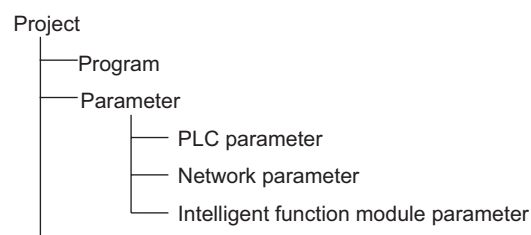
Figure 6.2 Project structure

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(b) Steps 1) to 3) shown in Figure 6.3 are performed as follows:

1) From GX Developer, select:

[Project] → [Open project]/[Save]/[Save as].

2) From the module selection screen of the utility, select:

[Intelligent function module parameter] → [Open parameters]/[Save parameters].

3) From GX Developer, select:

[Online] → [Read from PLC]/[Write to PLC] → "Intelligent function module parameters".

Or, from the module selection screen of the utility, select:

[Online] → [Read from PLC]/[Write to PLC].

(4) Text file

(a) A text file can be created by clicking the ⌐Make text file⌐ button on the initial setting, Auto refresh setting, or Monitor/Test screen. The text files can be utilized to create user documents.

(b) Text files can be saved in any directory. However, a path (folder where the file is to be saved) cannot be created during operation of ⌐Make text file⌐. Therefore, create the folder beforehand using Windows® Explorer.

A: Intelligent function module parameters
B: Data saved by "Make text file"
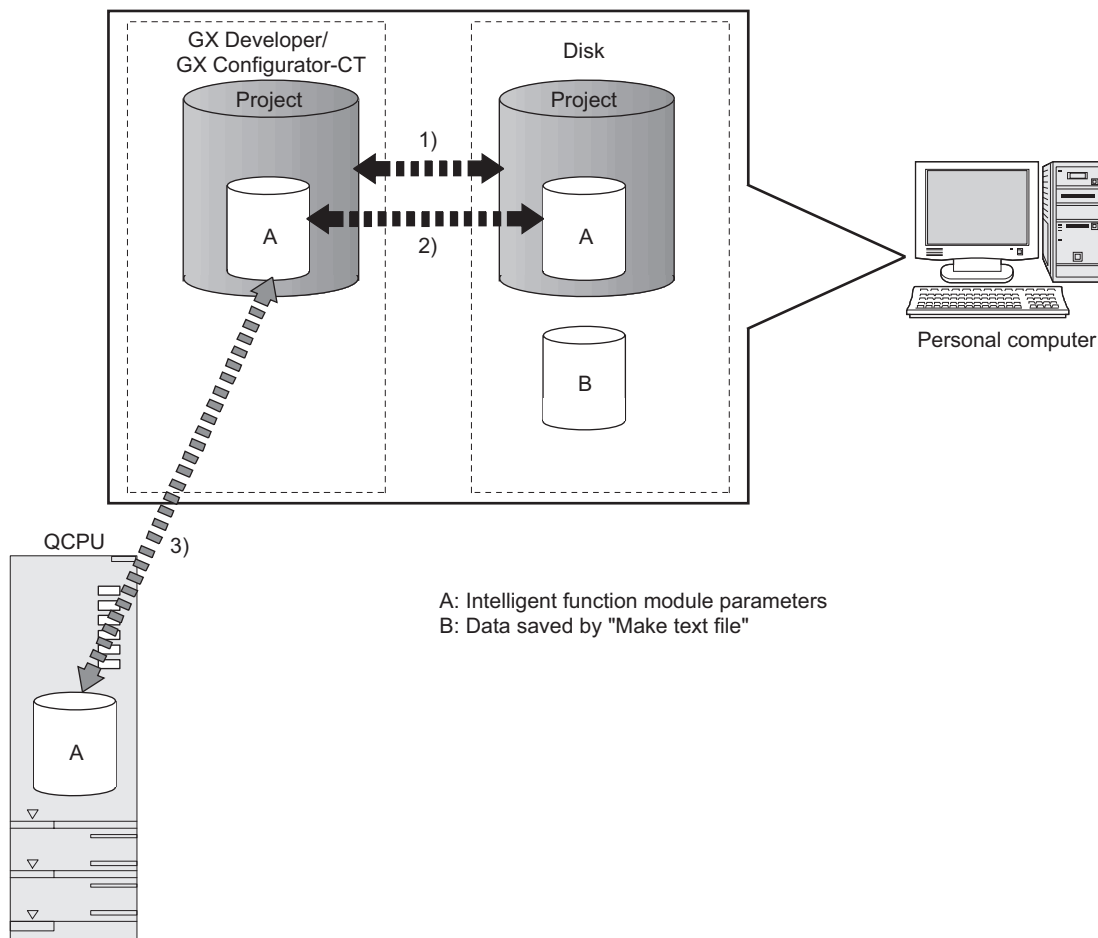
Figure 6.3 Correlation chart for data created with the utility package

6.3.2 Operation overview

GX Developer screen
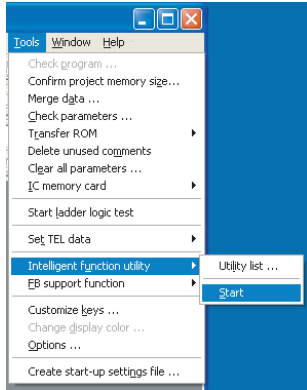
[Tools] - [Intelligent function utility] - [Start]

Screen for selecting a target
intelligent function module
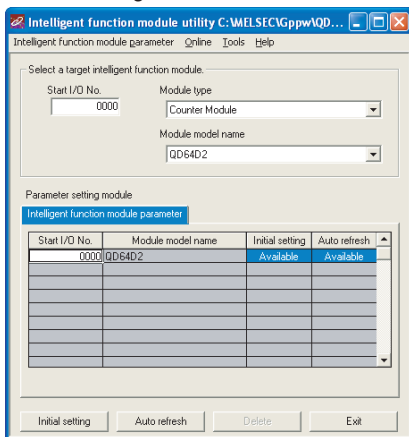
Refer to Section 6.3.3.

Enter "Start I/O No.", and select
"Module type" and "Module model name".

Initial setting

Auto refresh

1)

[Initial setting] screen

Refer to Section 6.4.

[Auto refresh setting] screen
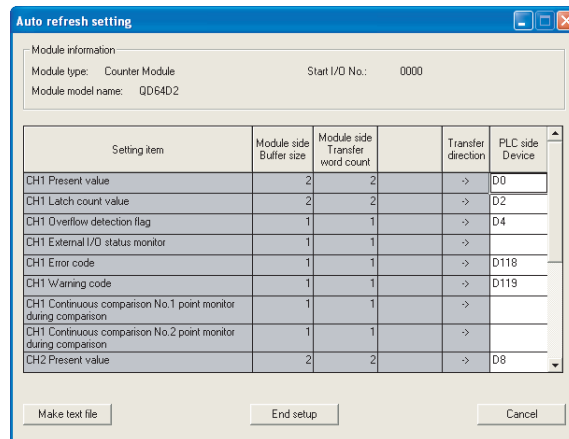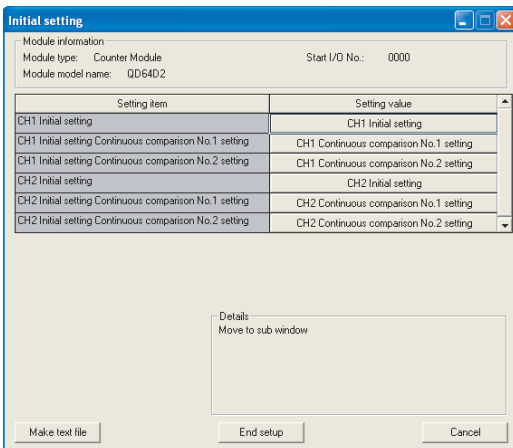
Refer to Section 6.5.

Figure 6.4 General operation

1) ——————————————┐

　　　　　　　　　[Online] - [Monitor/Test]

[Select monitor/test module] screen

Monitor/Test ──→ Select a module to be monitored/tested.

[Monitor/Test] screen

Refer to Section 6.6.
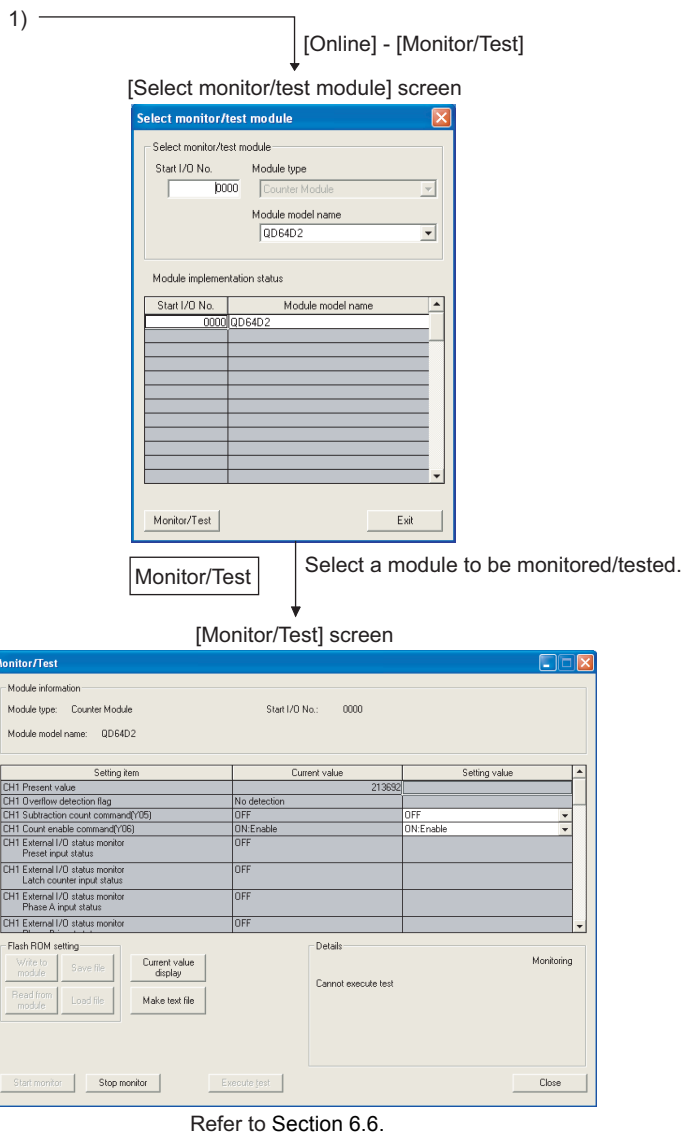
Figure 6.4 General operation (continued)

6.3.3   Starting the Intelligent function module utility

[Purpose]

Start the utility from GX Developer to display the [Intelligent function module utility] screen.

From this screen, [Initial setting], [Auto refresh setting], and [Select monitor/test module] (selection of the module which performs monitor/test) screens for the QD64D2 can be started.

[Operating procedure]

[Tools] → [Intelligent function utility] → [Start]

[Setting screen]
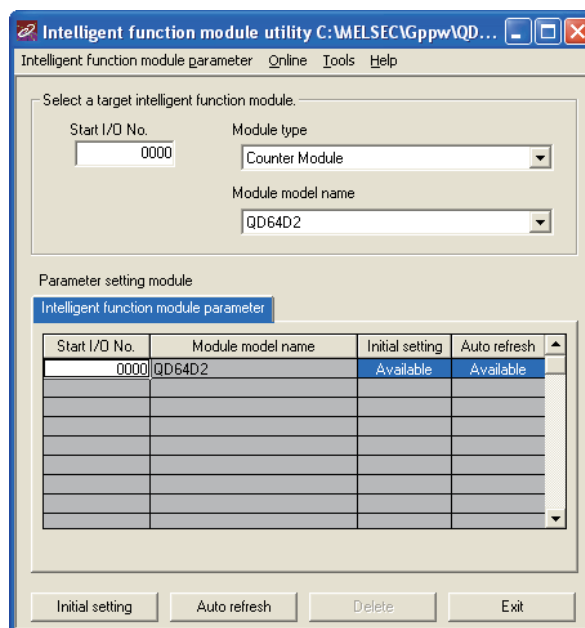
Figure 6.5 [Intelligent function module utility] screen

[Explanation of items]

(1) Activation of other screens

(a) [Initial setting] screen

[Start I/O No.*] → [Module type] → [Module model name] → [Initial setting]

(b) [Auto refresh setting] screen

[Start I/O No.*] → [Module type] → [Module model name] → [Auto refresh]

(c) Monitor/test module selection screen

[Online] → [Monitor/Test]

*   Enter the [Start I/O No.] in hexadecimal.

(2) Command buttons

Delete	Deletes the [Initial setting] and [Auto refresh setting] of the selected module.
Exit	Closes this screen.
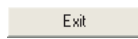
(3) Menu bar

(a) File menu
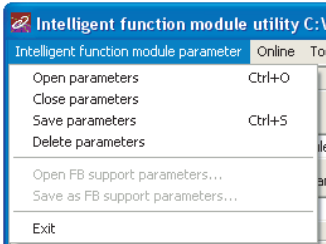
Intelligent function module parameters of the project opened by GX Developer are handled.

[Open parameters]   : Reads a parameter file.

[Close parameters]   : Closes the parameter file. If any data are modified, a dialog asking for file saving will appear.

[Save parameters]   : Saves the parameter file.

[Delete parameters]   : Deletes the parameter file.

[Open FB support parameter...] : Opens a FB support parameter file.

[Save as FB support parameter...] : Saves a FB support parameter.

[Exit]   : Exits the [Intelligent function module utility].

(b) Online menu
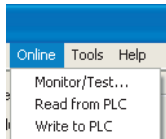
[Monitor/Test]   : Activates the [Select monitor/test module] screen.

[Read from PLC]   : Reads intelligent function module parameters from the CPU module.

[Write to PLC]   : Writes intelligent function module parameters to the CPU module.

⊠**POINT**

(1) Saving intelligent function module parameters in a file
   Since intelligent function module parameters cannot be saved in a file by the project saving operation of GX Developer, save them on the shown module selection screen.

(2) Reading/writing intelligent function module parameters from/to a programmable controller using GX Developer
   - Intelligent function module parameters can be read from and written into a programmable controller after having been saved in a file.
   - Set a target programmable controller CPU in GX Developer: [Online] - [Transfer setup].
   - When mounting the QD64D2 to the remote I/O station, use [Read from PLC]/[Write to PLC] of GX Developer.

(3) Checking the required utility
   While the start I/O is displayed on the Intelligent function module utility setting screen, " * " may be displayed for the model name.
   This means that the required utility has not been installed or the utility cannot be started from GX Developer.
   Check the required utility, selecting [Tools] - [Intelligent function utility] - [Utility list...] in GX Developer.

6.4 Initial Setting

[Purpose]

Make [Initial setting] for each channel to operate the QD64D2.

For parameter types of [Initial setting], refer to Section 6.1.

This setting allows skipping sequence program setting.

By making the initial settings, the sequence program settings become unnecessary.

[Operating procedure]

"Start I/O No.*" → "Module type" → "Module model name" → [Initial setting]

* Enter the [Start I/O No.] in hexadecimal.
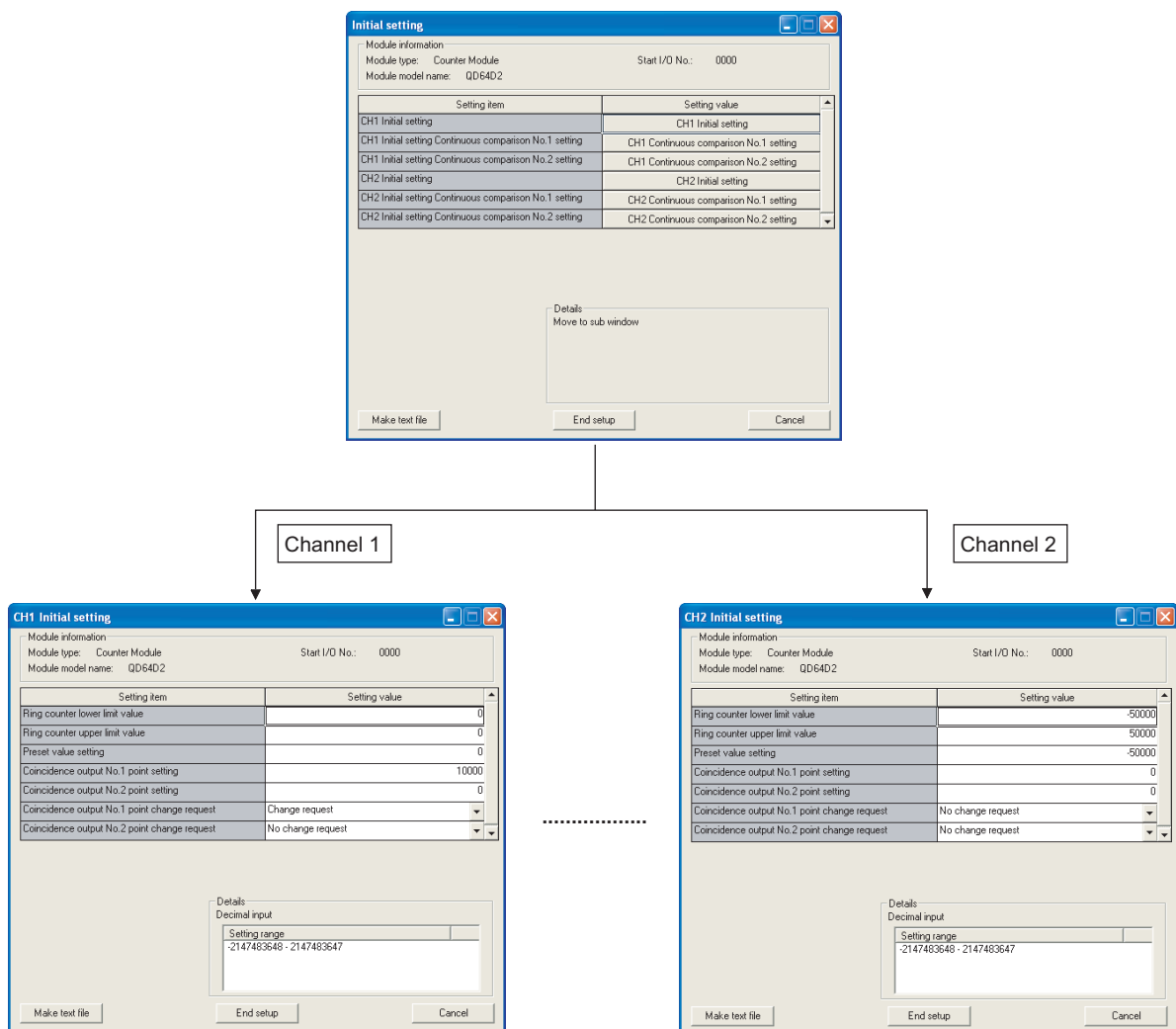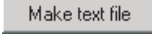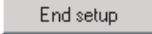
[Setting screen]

Figure 6.6 [Initial setting] screen

[Explanation of items]

(1) Command buttons

| Make text file | Creates a file containing the screen data in text file format. |

| End setup | Saves the set data and ends the operation. |

| Cancel | Cancels the setting and ends the operation. |

⊠**POINT**

Initial settings are stored to the intelligent function module parameters.
The initial settings become effective after writing them to the CPU module and executing (1) or (2).
(1) Change RUN/STOP switch on the CPU module STOP, RUN, STOP, and RUN again.
(2) After changing the switch to RUN, power OFF and then ON the CPU module or reset it.
When the initial setting contents are written with the sequence program, the initial settings are executed when the RUN/STOP switch is changed to STOP and RUN again, and initial setting values are written.
When the CPU module is switched to STOP and RUN again, execute the initial settings with the sequence program again.

6.5 Auto Refresh

[Purpose]

Set the buffer memory of the QD64D2 to which auto refresh is to be performed for each channel.

For parameter types of [Auto refresh setting], refer to Section 6.1.

This auto refresh setting eliminates the need for reading by sequence programs.

[Operating procedure]

"Start I/O No.*" → "Module type" → "Module model name" → <kbd>Auto refresh</kbd>

    * Enter the [Start I/O No.] in hexadecimal.
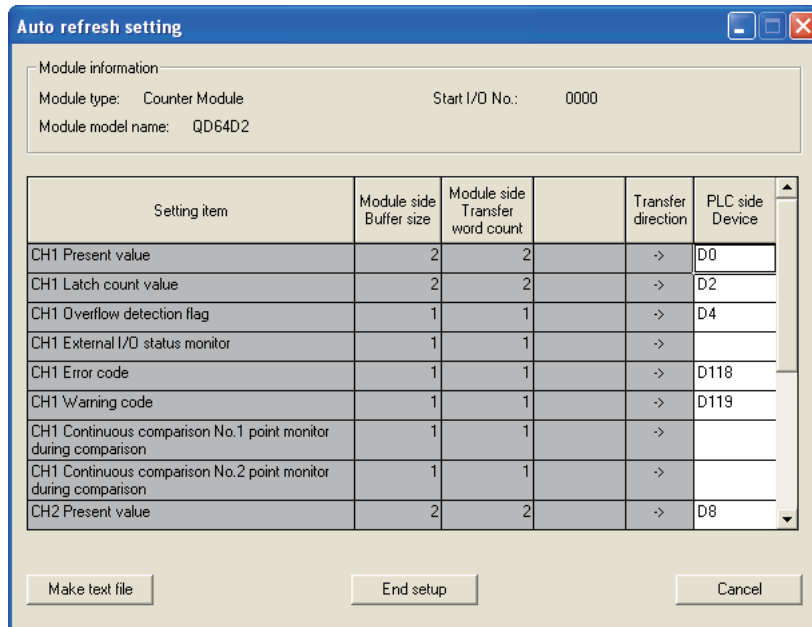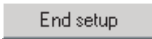
[Setting screen]

Figure 6.7 [Auto refresh setting] screen

[Explanation of items]

(1) Items

Module side Buffer size : Displays the buffer memory size of the setting item.

Module side Transfer word count : Displays the number of words to be transferred.

Transfer direction : "←" indicates that data are written from the programmable controller CPU to the buffer memory.

"→" indicates that data are loaded from the buffer memory to the programmable controller CPU.

PLC side Device : Enter a CPU module side device that is to be automatically refreshed.

Applicable devices are X, Y, M, L, B, T, C, ST, D, W, R, and ZR.

When using bit devices X, Y, M, L or B, set a number that can be divided by 16 points (examples: X10, Y120, M16, etc.)

Also, buffer memory data are stored in a 16-point area, starting from the specified device number. For example, if X10 is entered, data are stored in X10 to X1F.

(2) Command buttons

| Make text file | Creates a file containing the screen data in text file format. |

| End setup | Saves the set data and ends the operation. |

| Cancel | Cancels the setting and ends the operation. |

⊠ **POINT**

• The auto refresh settings are stored in an intelligent function module parameter file.
The auto refresh settings become effective by turning the power OFF and then ON or resetting the CPU module after writing the intelligent function module parameters to the CPU module.

• The auto refresh settings cannot be changed from sequence programs. However, processing equivalent to auto refresh can be added using the FROM/TO instruction in the sequence program.

6.6 Monitoring/Test

6.6.1 Monitoring/test

[Purpose]

Start buffer memory monitor/test and I/O signal monitor/test from this screen.

[Operating procedure]

"Select monitor/test module" screen → "Start I/O No.*" → "Module type" → "Module model name" → Monitor/Test .

* Enter the [Start I/O No.] in hexadecimal.

The screen can also be started from System monitor of GX Developer Version 6 or later.

Refer to the GX Developer Operating Manual for details.

[Setting screen]
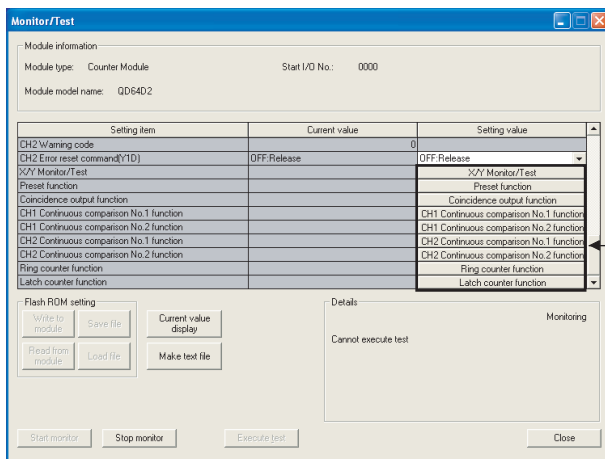
Selecting these buttons displays the following screens.

1)

X/Y Monitor/Test

Preset function

Figure 6.8 [Monitor/Test] screen

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Coincidence output function

Continuous comparison function

Ring counter function

Latch counter function

1)

Figure 6.8 [Monitor/Test] screen (continued)

[Explanation of items]

(1) Items

Setting item : Displays I/O signals and buffer memory names.

Current value : Monitors the I/O signal status and present buffer memory values.
Setting value : Enter or select values to be written into the buffer memory for test operation.

(2) Command buttons

Current value display

Make text file

Start monitor / Stop monitor
Execute test

Close

Displays the current value of the item selected. (This is used to check the text that cannot be displayed in the current value field. However, in this utility package, all items can be displayed in the display fields).

Creates a file containing the screen data in text file format.

Selects whether or not to monitor current values.

Performs a test on the selected items. To select more than one item, select them while holding down the ⌈ Ctrl ⌉ key.

Closes the screen that is currently open and returns to the previous screen.

Remark •

The following describes a method for using [Execute test] by an example when setting "3000" at [CH1 Preset value setting] and writing it to the QD64D2.

(1) Click the [Preset function] button in [Setting value] field to display the [Preset function] screen.

(2) Click [Setting value] field on [CH1 Preset value setting], enter "3000", and press the ⌈ Enter ⌉ key.
At this point, the value has not been written to the QD64D2 yet.

(3) Click [Setting value] field on [CH1 Preset command (Y04)] and select [ON].
At this point, the value has not been written to the QD64D2 yet.

(4) Select [Setting value] fields entered by operations (2) and (3) while pressing the ⌈ Ctrl ⌉ key. Multiple items can be selected by dragging operation.
(Selected [Setting value] fields are inverted.)

(5) Click the ⌈ Execute test ⌉ button and write setting values of the items selected at (4) to the QD64D2.

After writing, the values entered at (2) and (3) are displayed at [Current value] fields.

• •

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CHAPTER7 PROGRAMMING

This chapter describes the programs of the QD64D2.

When applying any of the program examples introduced in this chapter to the actual system, verify the applicability and confirm that no problems will occur in the system control.

7.1 Programming Procedure

Create a program activating a count by the QD64D2 by the following procedures.
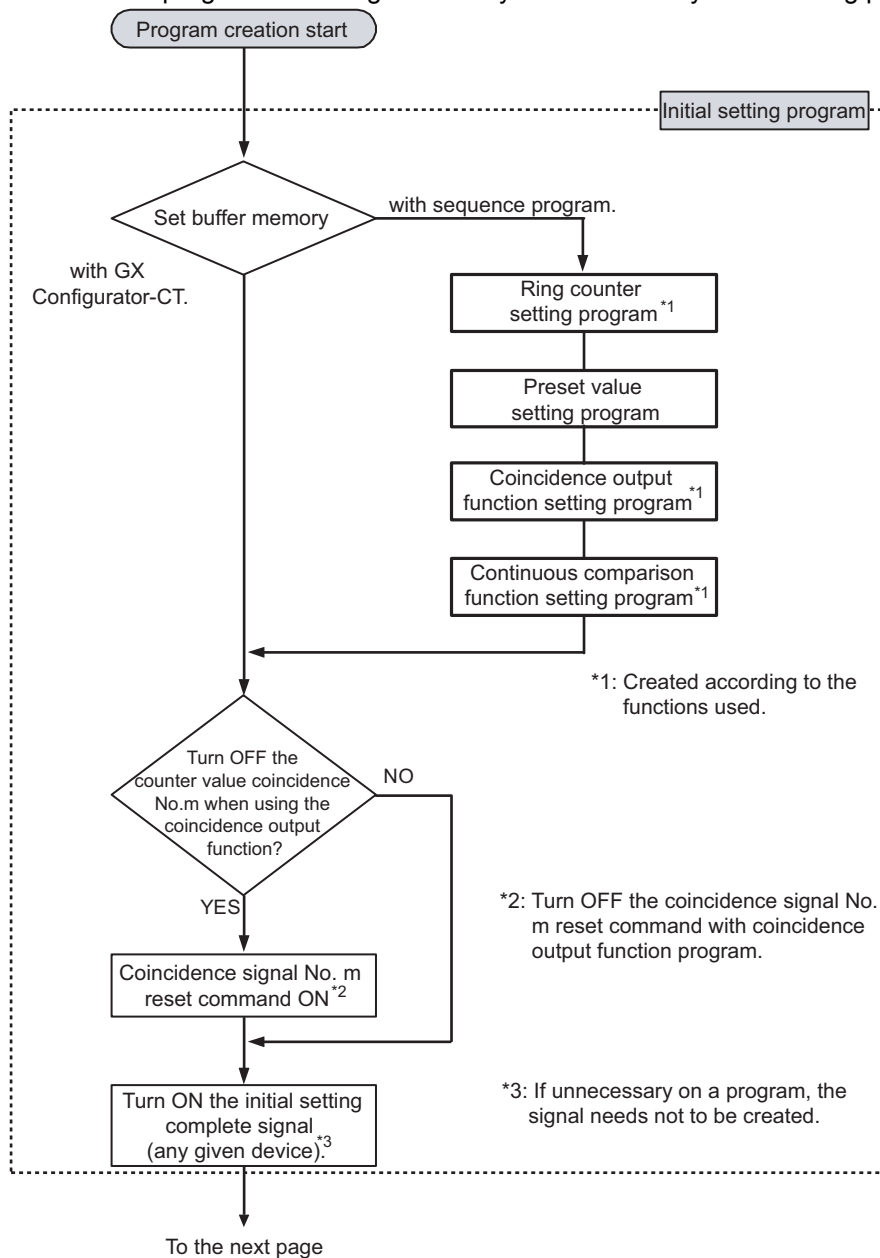
Figure 7.1 Program creation procedures

From the previous page
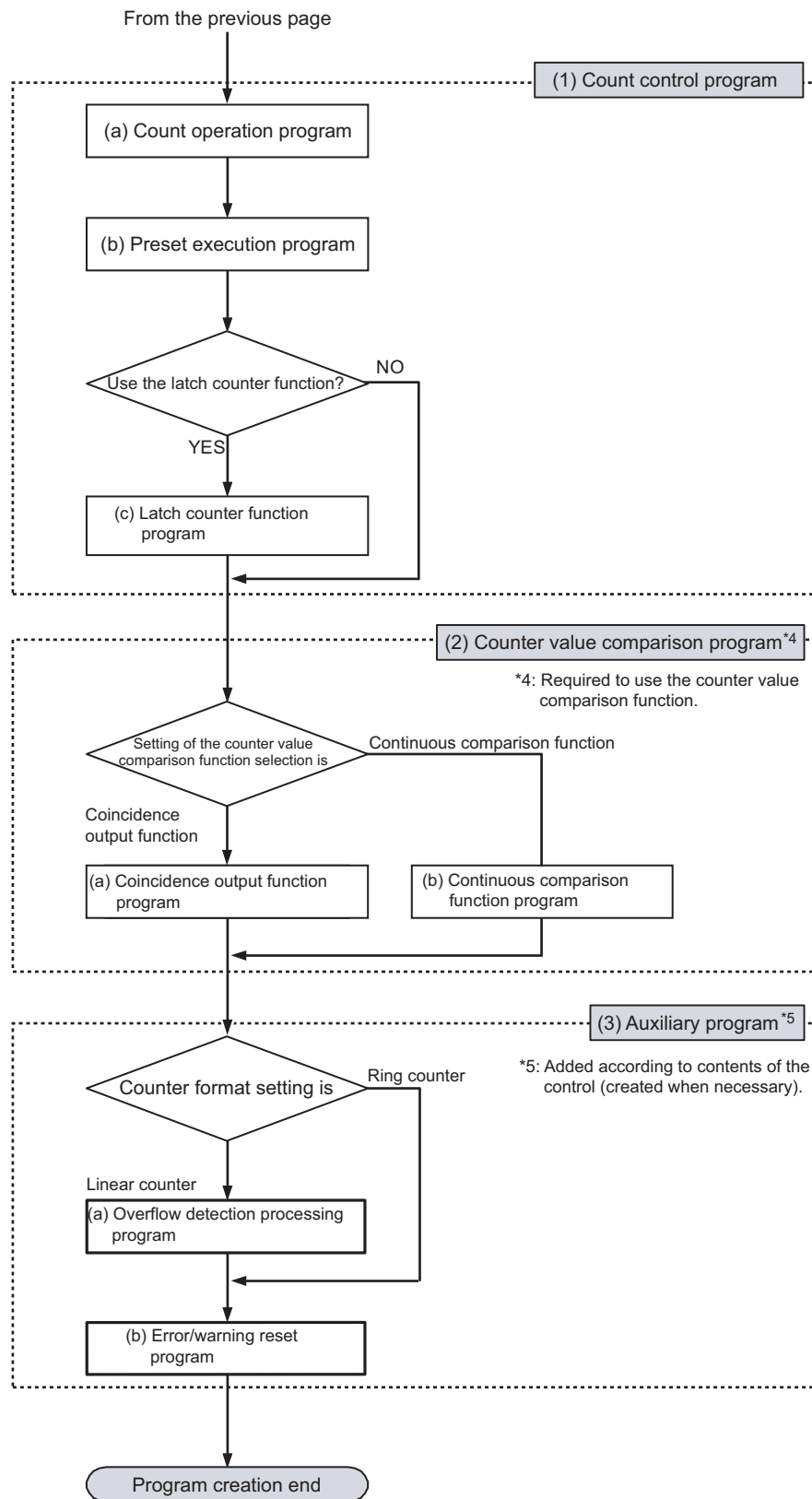
Figure 7.1 Program creation procedures (continued)

*4: Required to use the counter value comparison function.

*5: Added according to contents of the control (created when necessary).

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7.2 For Use in Normal System Configuration

This section describes a program example under the following system configuration and use conditions.

(1) System configuration

QCPU
QD64D2(X/Y00 to X/Y1F)

CH1 encoder

CH2 encoder

QY40P(Y30 to Y3F)
QX40(X20 to X2F)
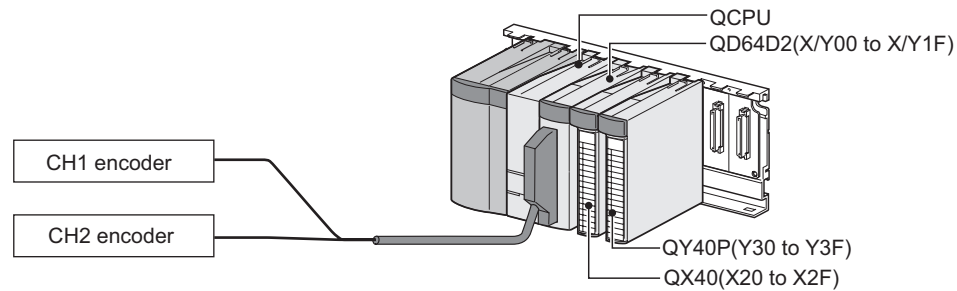
Figure 7.2 System configuration

(2) Conditions for the intelligent function module switch setting

Table 7.1 Conditions for the intelligent function module switch setting

Channel	Pulse input mode	Counter format	Counter value comparison function selection
CH1	CW/CCW	Linear counter	Coincidence output function
CH2	CW/CCW	Ring counter	Continuous comparison function

(3) Program conditions (intial setting)

(a) Preset the following values to each channel.
- CH1: 0
- CH2: - 50000

(b) CH1 uses the coincidence output function (refer to Section 5.3.1).[1]
- Coincidence output No.1 point setting: 10000
- Coincidence output No.1 point change request: Change request

* 1: This program example does not use the coincidence output No.2. CH1 counter value coincidence No.2 (X05) turns ON at default.

(c) CH2 uses the continuous comparison function (refer to Section 5.3.2).[2]
- Continuous comparison No.1 start point setting: 1
- Continuous comparison No.1 repeat point setting: 2
- Continuous comparison No.1 ON time setting: 10ms
- Continuous comparison No.1 point 1 setting: 20000
- Continuous comparison No.1 point 2 setting: 40000

* 2: This program example does not use the continuous comparison No.2.

(d) CH2 uses the ring counter function (refer to Section 5.2.2).
- Ring counter lower limit value: - 50000
- Ring counter upper limit value: 50000

7.2.1 Before creating a program

Perform the following steps before creating a program.

(1) Wiring of external devices

Mount the QD64D2 on the base unit and connect the external devices.
• Wire encoders to all CH1 and CH2 (refer to Section 4.4.2).

[Wiring diagram]
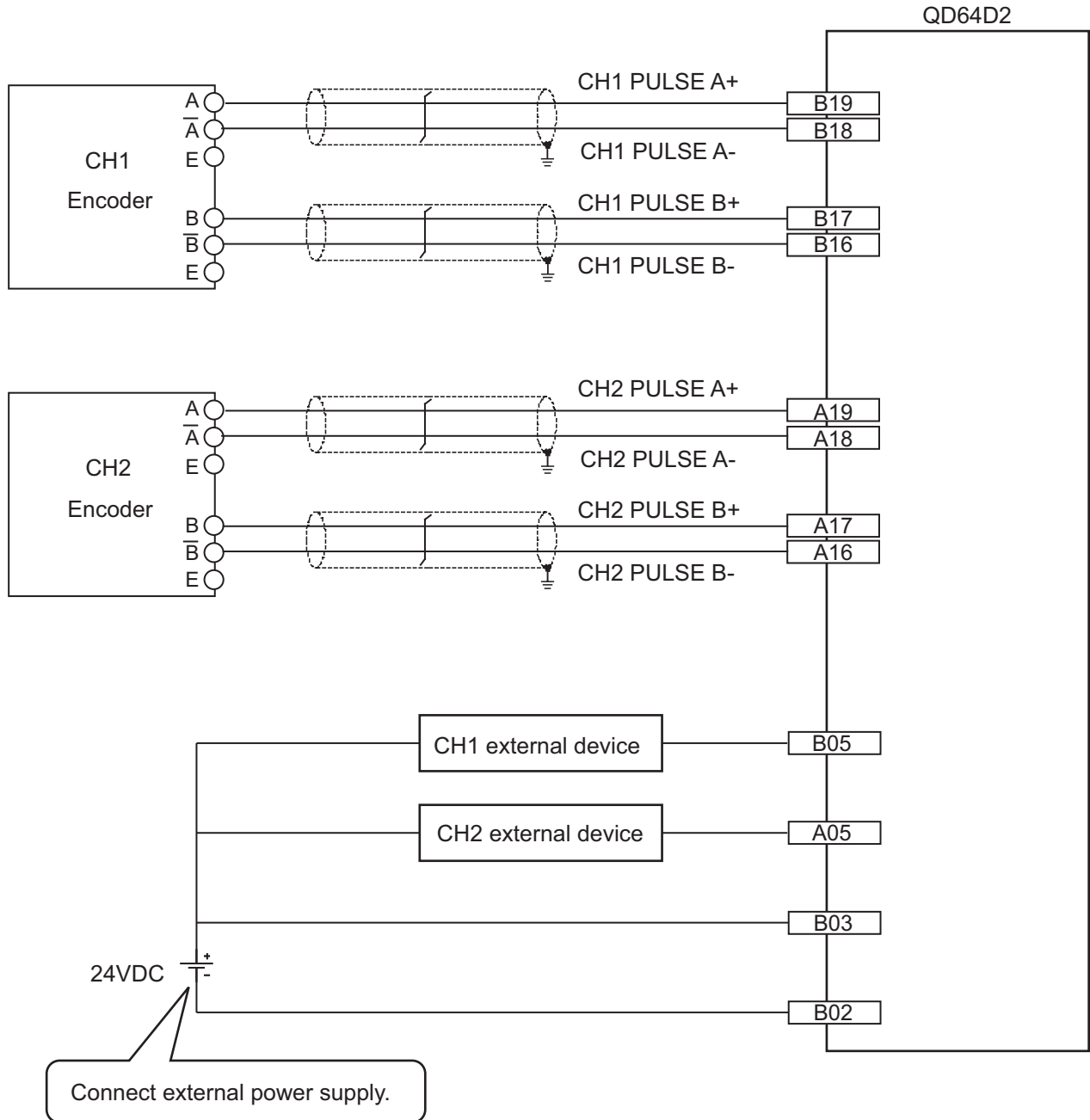
Figure 7.3 Wiring example of the program example

(2) Intelligent function module switch setting

Based on the setting conditions given in Section 7.2 (2), make the intelligent function module switch settings.

(a) Each switch setting

1) Switch 1: CH1 setting
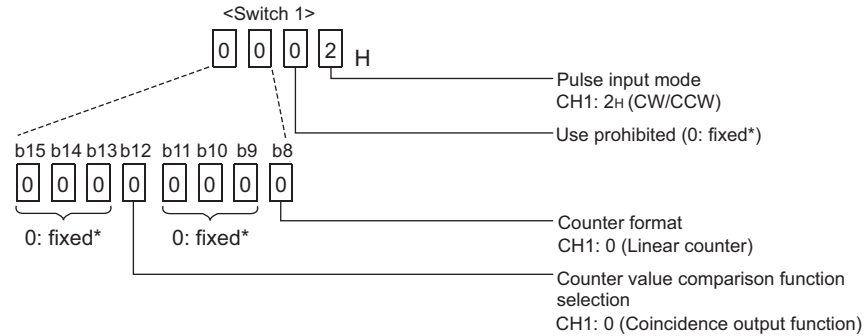
2) Switch 2: CH2 setting
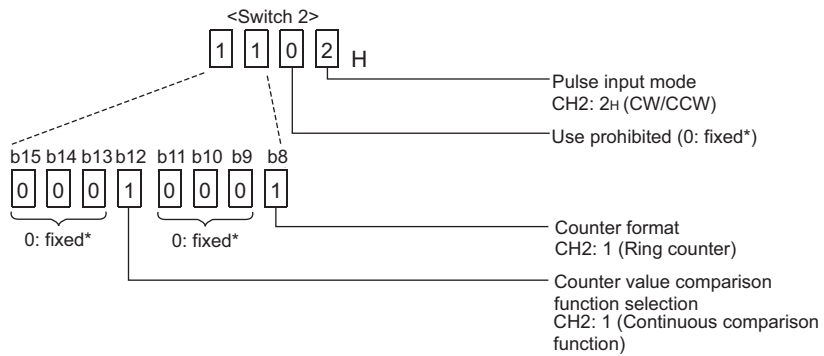
3) Switch 3, switch 4, switch 5: Use prohibited (0: fixed)
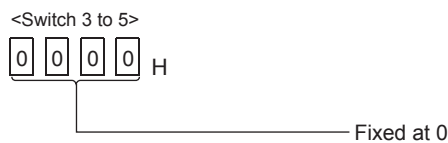
* If any other than 0 is set to the switches from 1 to 5 where 0 is fixed, the functions of the QD64D2 are not guaranteed.

(b) Write the settings in (a) to the QD64D2.
On GX Developer's "Parameter setting" screen, select the "I/O assignment" tab, click "Switch setting", and make settings of Switch 1 to 5 on the screen shown below.
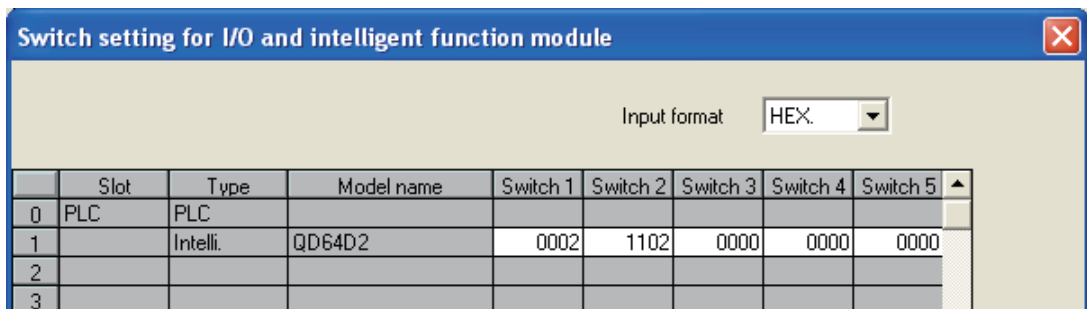
7.3 Programming Example when GX Configurator-CT is Used

(1) List of devices

Table 7.2 List of devices

Device	Function	
D0,D1	CH1 present value storage	
D2,D3[*1]	CH1 latch count value storage	
D4[*2]	CH1 overflow status storage	
D5[*3]	CH1 error code storage	
D6[*4]	CH1 warning code storage	
D8,D9	CH2 present value storage	
D10[*3]	CH2 error code storage	
D11[*4]	CH2 warning code storage	
D118	CH1 error code	
D119	CH1 warning code	
D120	CH2 error code	
D121	CH2 warning code	
M10	Initial setting complete signal	
X00	Module READY	
X02	CH1 counter value coincidence No.1	
X0D	CH1 error occurrence	
X0E	CH1 warning occurrence	
Y01[*5]	CH1 coincidence signal No.1 reset command	
Y03[*5]	CH1 coincidence output enable command	
Y04	CH1 preset command	
Y06	CH1 count enable command	
Y07	CH1 latch counter execution command	QD64D2 (X/Y00 to X/Y1F)
Y0D	CH1 error reset command	
X12	CH2 counter value coincidence No.1	
X1D	CH2 error occurrence	
X1E	CH2 warning occurrence	
Y14	CH2 preset command	
Y16	CH2 count enable command	
Y19[*6]	CH2 continuous comparison No.1 execution command	
Y1D	CH2 error reset command	
X20	CH1 count operation start signal	
X21	CH1 count operation stop signal	
X23	CH1 preset command signal	
X24[*1]	CH1 latch execution command signal	
X26[*5]	CH1 coincidence output enable signal	
X27[*5]	CH1 coincidence LED clear signal	QX40 (X20 to X2F)
X28	CH1 error/warning reset command signal	
X2A	CH2 count operation start signal	
X2B	CH2 count operation stop signal	
X2D	CH2 preset command signal	
X2E[*6]	CH2 continuous comparison execution signal	
X2F	CH2 error/warning reset command signal	

Table 7.2 List of devices (continued)

Device	Function	
Y30	CH1 coincidence confirmation LED signal	QY40P (Y30 to Y3F)
Y31*2	CH1 overflow occurrence confirmation LED signal	
Y32	CH2 coincidence confirmation LED signal	

* 1 Set this only when using the latch counter function.
* 2 Set this only when using the linear counter function.
* 3 Stores last occurred error and holds it even after error reset.
* 4 Stores last occurred warning and holds it even after error reset.
* 5 Set this only when using the coincidence output function.
* 6 Set this only when using the continuous comparison function.

(2) Operating the GX Configurator-CT

(a) Initial setting
Set the initial settings of CH1 and 2.
Refer to Section 7.2 for the settings.
For Initial setting in GX Configurator-CT, refer to Section 6.4.
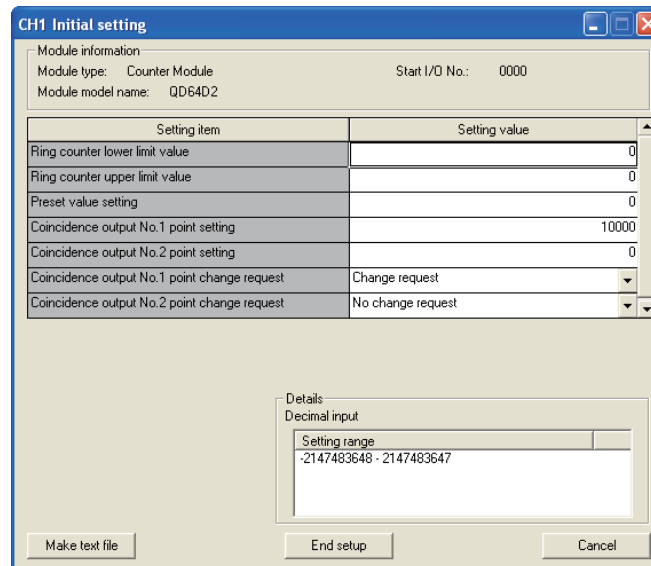
Figure 7.4 [Initial setting] screen

Table 7.3 Item on the [Initial setting] screen

Setting item		Description	Setting
CH1 Initial setting	Preset value setting	Set preset value.	0
	Coincidence output No.1 point setting	Set these only when the counter value comparison function selection (refer to Section 4.5) is the coincidence output function.	10000
	Coincidence output No.1 point change request		Change request
CH2 Initial setting	Ring counter lower limit value	Set these only when using the ring counter function.	-50000
	Ring counter upper limit value		50000
	Preset value setting	Set preset value.	-50000
CH2 continuous comparison No.1 setting	Continuous comparison No.1 start point setting	Set these only when the counter value comparison function selection (refer to Section 4.5) is the continuous comparison function.	1
	Continuous comparison No.1 repeat point setting		2
	Continuous comparison No.1 ON time setting		10
	Continuous comparison No.1 point 1 setting		20000
	Continuous comparison No.1 point 2 setting		40000

(b) Auto refresh setting

Set devices storing the present values, latch count values, overflow detection flags, error codes, and warning codes of CH1 and CH2.

For Auto refresh setting in GX Configurator-CT, refer to Section 6.5.
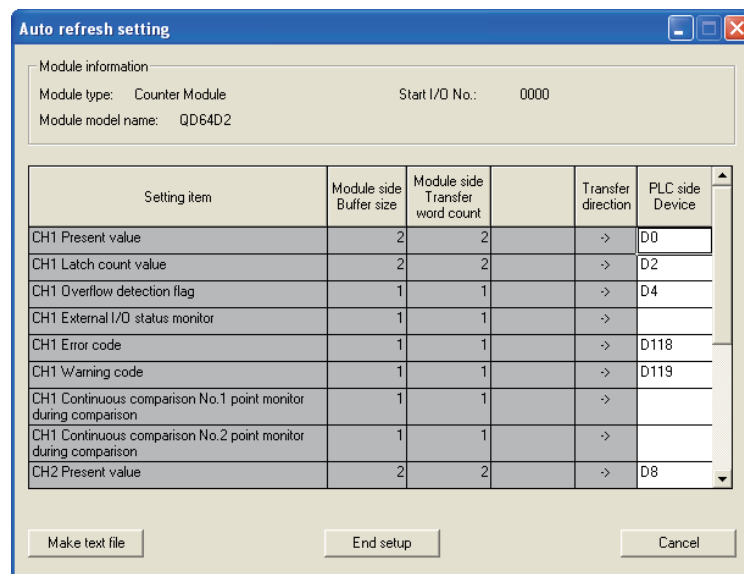
Figure 7.5 Auto refresh setting screen

Table 7.4 Auto refresh setting

Description	Setting value
CH1 Present value	D0
CH1 Latch count value[*1]	D2
CH1 Overflow detection flag[*2]	D4
CH2 Present value	D8
CH1 Error code	D118
CH1 Warning code	D119
CH2 Error code	D120
CH2 Warning code	D121

* 1 Set this only when using the latch counter function.
* 2 Set this only when using the linear counter function.

(c) Writing the intelligent function module parameters

Write the intelligent function module parameters to the CPU module.

This operation is performed using the parameter setting module selection screen.

For writing of intelligent function module parameters with GX Configurator-CT, refer to Section 6.3.3.

(3) Programming example

```
* Initial setting program
*  Resets the coincidence signal at power-ON.
        X0        Y6        M10
        ┤├────────┤╱├───────┤╱├────────────────────────────[SET    Y1 ]      CH1 coincidence signal No.1
                                                                            reset command (Y01) ON
                                                            [SET    M10]

* CH1 program
*
*  (1) Count control program
*   (1)-a Count operation program
*     Starts count operation.
        X0        X20
        ┤├────────┤├───────────────────────────────────────[SET    Y6 ]      CH1 count enable
                                                                            command (Y06) ON
*     Stops count operation.
        X0        X21
        ┤├────────┤├───────────────────────────────────────[RST    Y6 ]      CH1 count enable
                                                                            command (Y06) OFF
*   (1)-b Preset execution program
*     Sets the present value as preset value.
        X0        X23
        ┤├────────┤├───────────────────────────────────────────(Y4 )        CH1 preset
                                                                            command (Y04) ON
*   (1)-c Latch counter function program
*     Latches the present value.
        X0        X24
        ┤├────────┤├───────────────────────────────────────────(Y7 )        CH1 latch counter execution
                                                                            command (Y07) ON
*  (2) Counter value comparison program
*   (2)-a Coincidence output function program
*     Setting for outputting the counter value coincidence signal
*     outside
        X0        X26
        ┤├────────┤├───────────────────────────────────────────(Y3 )        CH1 coincidence output
                                                                            enable command (Y03) ON
*     Processing at count value coincidence
        X0        Y3        X2        Y1
        ┤├───┬────┤├────────┤├───────┤╱├────────────────────────(Y30)        CH1 coincidence
            │                                                               confirmation LED signal ON
            │     X2        X27
            ├─────┤├────────┤├──────────────────────────────[SET    Y1 ]      CH1 counter value
            │                                                               coincidence No.1 (X02) OFF
            │     X2        Y1
            └─────┤╱├───────┤├──────────────────────────────[RST    Y1 ]

*  (3) Auxiliary program
*   (3)-a Overflow detection processing program
*     Overflow detection processing
        X0
        ┤├───[=     D4      K1  ]───────────────────────────────(Y31)        CH1 overflow occurrence
                                                                            confirmation LED signal ON
*   (3)-b Error/warning reset program
*     Error/warning reset processing
        X0D
        ┤├───[<>    D118    K0  ]───────────────────────[MOV   D118   D5 ]   Stores CH1 error code to D5.

        X0E
        ┤├───[<>    D119    K0  ]───────────────────────[MOV   D119   D6 ]   Stores CH1 warning
                                                                            code to D6.
        X28       X0D
        ┤├───┬────┤├───────────────────────────────────────────(Y0D)        CH1 error reset
            │                                                               command (YD0) ON
            │     X0E
            └─────┤├
```

```
* CH2 program
*
* (1) Count control program
*  (1)-a Count operation program
*   Starts count operation.
         X0    X2A
         ┤├────┤├─────────────────────────────────────[SET    Y16  ]
*   Stops count operation.
         X0    X2B
         ┤├────┤├─────────────────────────────────────[RST    Y16  ]
*  (1)-b Preset execution program
*   Sets the present value as preset value.
         X0    X2D
         ┤├────┤├──────────────────────────────────────────(Y14 )
* (2) Counter value comparison program
*  (2)-b Continuous comparison function program
*   Executes continuous comparison.
         X0    X2E
         ┤├────┤├──────────────────────────────────────────(Y19 )

         X0    Y19   X12
         ┤├────┤├────┤├─────────────────────────────────────(Y32 )

* (3) Auxiliary program
* (3)-a Error/warning reset program
*   Error/warning reset processing
         X1D
         ┤├──[<>   D120   K0  ]──────────────────[MOV   D120   D10  ]

         X1E
         ┤├──[<>   D121   K0  ]──────────────────[MOV   D121   D11  ]

         X2F   X1D
         ┤├─┬──┤├──────────────────────────────────────────(Y1D )
            │ X1E
            └──┤├

                                                            [END  ]
```

CH2 count enable command (Y16) ON

CH2 count enable command (Y16) OFF

CH2 preset command (Y14) ON

CH2 continuous comparison No.1 execution command (Y19) ON

CH2 coincidence confirmation LED signal ON

Stores CH2 error code to D10.

Stores CH2 warning code to D11.

CH2 error reset command (Y1D) ON

7 PROGRAMMING

7.4 Programming Example when GX Configurator-CT is not Used

(1) List of devices

Table 7.5 List of devices

Device	Function	
D0,D1	CH1 present value storage	
D2,D3[*1]	CH1 latch count value storage	
D4[*2]	CH1 overflow status storage	
D5[*3]	CH1 error code storage	
D6[*4]	CH1 warning code storage	
D118	CH1 error code	
D119	CH1 warning code	
D8,D9	CH2 present value storage	
D10[*3]	CH2 error code storage	
D11[*4]	CH2 warning code storage	
D120	CH2 error code	
D121	CH2 warning code	
M10	Initial setting complete signal	
X00	Module READY	
X02	CH1 counter value coincidence No.1	
X0D	CH1 error occurrence	
X0E	CH1 warning occurrence	
Y01[*5]	CH1 coincidence signal No.1 reset command	
Y03[*5]	CH1 coincidence output enable command	
Y04	CH1 preset command	
Y06	CH1 count enable command	
Y07	CH1 latch counter execution command	QD64D2 (X/Y00 to X/Y1F)
Y0D	CH1 error reset command	
X12	CH2 counter value coincidence No.1	
X1D	CH2 error occurrence	
X1E	CH2 warning occurrence	
Y14	CH2 preset command	
Y16	CH2 count enable command	
Y19[*6]	CH2 continuous comparison No.1 execution command	
Y1D	CH2 error reset command	

Table 7.5 List of devices (continued)

Device	Function	
X20	CH1 count operation start signal	
X21	CH1 count operation stop signal	
X22	CH1 present value read signal	
X23	CH1 preset command signal	
X24[*1]	CH1 latch execution command signal	
X25[*1]	CH1 latch count data read signal	
X26[*5]	CH1 coincidence output enable signal	QX40 (X20 to X2F)
X27[*5]	CH1 coincidence LED clear signal	
X28	CH1 error/warning reset command signal	
X2A	CH2 count operation start signal	
X2B	CH2 count operation stop signal	
X2C	CH2 present value read signal	
X2D	CH2 preset command signal	
X2E[*6]	CH2 continuous comparison execution signal	
X2F	CH2 error/warning reset command signal	
Y30	CH1 coincidence confirmation LED signal	
Y31[*2]	CH1 overflow occurrence confirmation LED signal	QY40P (Y30 to Y3F)
Y32	CH2 coincidence confirmation LED signal	

* 1 Set this only when using the latch counter function.
* 2 Set this only when using the linear counter function.
* 3 Stores last occurred error and holds it even after error reset.
* 4 Stores last occurred warning and holds it even after error reset.
* 5 Set this only when using the coincidence output function.
* 6 Set this only when using the continuous comparison function.

(2) Program example

```
* Initial setting program
     X0      Y6      Y16     M10                                         U0\
     ┤├──────┤/├─────┤/├─────┤/├──────────────────────[DMOVP   K0      G4   ]     CH1 preset value setting
                              │                                         U0\
                              │                        [DMOVP   K10000  G6   ]     CH1 coincidence output
                              │                                                    No.1 point setting
                              │                                         U0\
                              │                        [MOVP    K1      G10  ]     CH1 coincidence output
                              │                                                    No.1 point change request
                              │                        [SET             Y1   ]     CH1 coincidence signal
                              │                                                    No.1 reset command (Y01) ON
                              │                                         U0\
                              │                        [DMOVP   K-50000 G200 ]     CH2 ring counter lower limit
                              │                                                    value setting
                              │                                         U0\
                              │                        [DMOVP   K50000  G202 ]     CH2 ring counter upper/lower
                              │                                                    limit value setting
                              │                                         U0\
                              │                        [DMOVP   K-50000 G204 ]     CH2 preset value setting
                              │                                         U0\
                              │                        [MOVP    K1      G250 ]     CH2 continuous comparison
                              │                                                    No.1 start point setting
                              │                                         U0\
                              │                        [MOVP    K2      G251 ]     CH2 continuous comparison
                              │                                                    No.1 repeat point setting
                              │                                         U0\
                              │                        [MOVP    K10     G252 ]     CH2 continuous comparison
                              │                                                    No.1 ON time setting
                              │                                         U0\
                              │                        [DMOVP   K20000  G254 ]     CH2 continuous comparison
                              │                                                    No.1 point 1 setting
                              │                                         U0\
                              │                        [DMOVP   K40000  G256 ]     CH2 continuous comparison
                              │                                                    No.1 point 2 setting
                              │                        [SET             M10  ]

* CH1 program
*
*  (1) Count control program
*  (1)-a Count operation program
*   Starts count operation.
     X0      X20
     ┤├──────┤├─────────────────────────────────────────[SET            Y6   ]     CH1 count enable command
                                                                                   (Y06) ON
*   Stops count operation.
     X0      X21
     ┤├──────┤├─────────────────────────────────────────[RST            Y6   ]     CH1 count enable command
                                                                                   (Y06) OFF
*   Present value storage
     X0      X22                                          U0\
     ┤├──────┤├─────────────────────────────────────────[DMOV    G12     D0   ]     Stores CH1 present value to D0.

*  (1)-b Preset execution program
*   Sets the present value as preset value.
     X0      X23
     ┤├──────┤├────────────────────────────────────────────────────────( Y4 )      CH1 preset command (Y04) ON

*  (1)-c Latch counter function program
*   Latches the present value.
     X0      X24
     ┤├──────┤├────────────────────────────────────────────────────────( Y7 )      CH1 latch counter execution
             │                                                                      command (Y07) ON
             X25                                          U0\
             ┤├───────────────────────────────────────────[DMOV    G14     D2   ]   Stores CH1 latch count value
                                                                                    to D2.
```
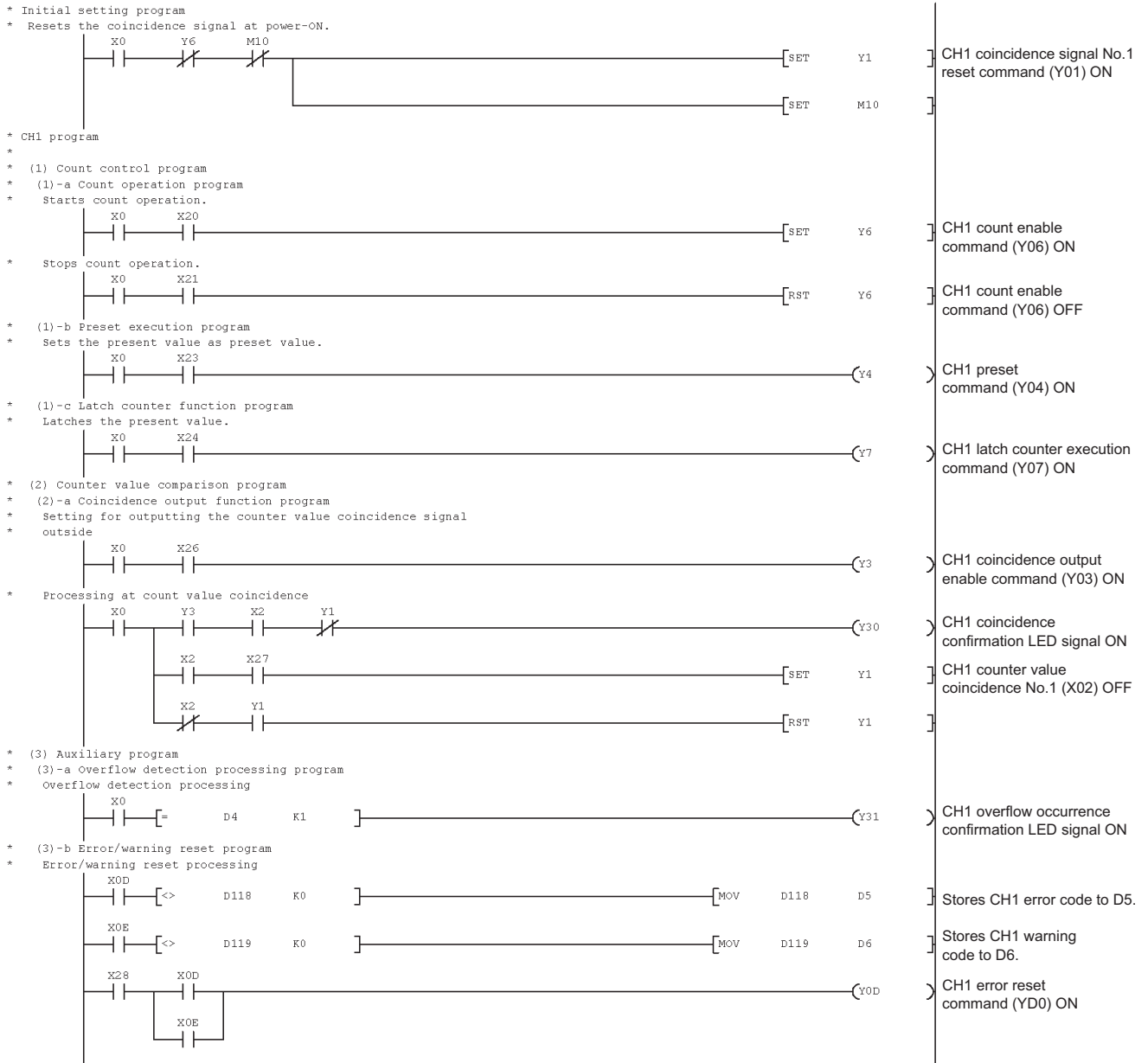
1 OVERVIEW
2 SYSTEM CONFIGURATION
3 SPECIFICATIONS
4 PROCEDURES AND SETTINGS BEFORE OPERATION
5 FUNCTIONS
6 UTILITY PACKAGE (GX Configurator-CT)
7 PROGRAMMING
8 TROUBLESHOOTING

```
*   (2) Counter value comparison program
*   (2)-a Coincidence output function program
*   Setting for outputting the counter value coincidence signal
*   outside
        X0      X26                                                    (Y3  )         CH1 coincidence output enable
        ┤├──────┤├─────────────────────────────────────────────────                  command (Y03) ON

*   Processing at count value coincidence
        X0      Y3      X2      Y1                                      (Y30 )         CH1 coincidence confirmation
        ┤├──────┤├──────┤├──────┤╱├─────────────────────────────────                  LED signal ON

        X2      X27                                        ┌─SET    Y1 ┐              CH1 counter value coincidence
        ┤├──────┤├─────────────────────────────────────────           ─              No.1 (X02) OFF

        X2      Y1                                         ┌─RST    Y1 ┐
        ┤╱├─────┤├──────────────────────────────────────               ─

*   (3) Auxiliary program
*   (3)-a Overflow detection processing program
*   Overflow detection processing
        X0                                                         U0\              Stores CH1 overflow status to
        ┤├──────────────────────────────────────────┌─MOV  G16     D4  ┐            D4.

               ┌─=      D4      K1   ─┐                              (Y31 )         CH1 overflow occurrence
                                                                                    confirmation LED signal ON

*   (3)-b Error/warning reset program
*   Error/warning reset processing
        X0D                                                        U0\              Stores CH1 error code to D118.
        ┤├──────────────────────────────────────────┌─MOV  G18     D118┐

               ┌─<>     D118    K0   ─┐               ┌─MOV  D118   D5  ┐            Stores a value of D118 to D5
                                                                                    when error code is stored in
                                                                                    D118.
        X0E                                                        U0\              Stores CH1 warning code to
        ┤├──────────────────────────────────────────┌─MOV  G19     D119┐            D119.

               ┌─<>     D119    K0   ─┐               ┌─MOV  D119   D6  ┐            Stores a value of D119 to D6
                                                                                    when warning code is stored in
                                                                                    D119.
        X28     X0D                                                    (Y0D )        CH1 error reset command
        ┤├──────┤├────────────────────────────────────────────────                  (YD0) ON

                X0E
                ┤├

*   CH2 program
*
*   (1) Count control program
*   (1)-a Count operation program
*   Starts count operation.
        X0      X2A                                        ┌─SET    Y16 ┐           CH2 count enable command
        ┤├──────┤├─────────────────────────────────────────           ─            (Y16) ON

*   Stops count operation.
        X0      X2B                                        ┌─RST    Y16 ┐           CH2 count enable command
        ┤├──────┤├─────────────────────────────────────────           ─            (Y16) OFF

*   Present value storage
        X0      X2C                                                U0\              Stores CH2 present value to
        ┤├──────┤├───────────────────────────────────┌─DMOV G212    D8  ┐           D8.

*   (1)-b Preset execution program
*   Sets the present value as preset value.
        X0      X2D                                                    (Y14 )        CH2 preset command (Y14)
        ┤├──────┤├────────────────────────────────────────────────                  ON

*   (2) Counter value comparison program
*   (2)-b Continuous comparison function program
*   Executes continuous comparison.
        X0      X2E                                                    (Y19 )        CH2 continuous comparison
        ┤├──────┤├────────────────────────────────────────────────                  No.1 execution command
                                                                                    (Y19) ON
        X0      Y19     X12                                            (Y32 )        CH2 coincidence confirmation
        ┤├──────┤├──────┤├────────────────────────────────────────                  LED signal ON
```
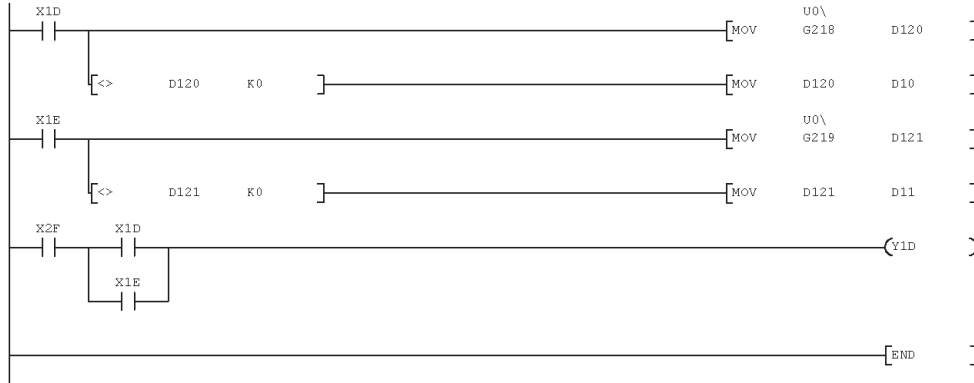
```
*   (3) Auxiliary program
*   (3)-a Error/warning reset program
*     Error/warning reset processing
        X1D                                                        U0\
        ├─┤ ├──────────────────────────────────────────────[MOV   G218    D120 ]    Stores CH2 error code to D120.

            ├─[<>    D120    K0    ]─────────────────────────[MOV   D120    D10  ]    Stores a value of D120 to D10
                                                                                     when error code is stored in
                                                                                     D120.
        X1E                                                        U0\
        ├─┤ ├──────────────────────────────────────────────[MOV   G219    D121 ]    Stores CH2 warning code to
                                                                                     D121.
            ├─[<>    D121    K0    ]─────────────────────────[MOV   D121    D11  ]    Stores a value of D121 to D11
                                                                                     when warning code is stored in
                                                                                     D121.
        X2F     X1D
        ├─┤ ├───┤ ├───────────────────────────────────────────────────────(Y1D  )   CH2 error reset command
            │   X1E                                                                   (Y1D) ON
            ├───┤ ├───┤

        ├──────────────────────────────────────────────────────────────────[END  ]
```

7.5 Program Example when the Coincidence Detection Interrupt Function is Used

This section describes a program example to start an interrupt program upon detecting coincidence of comparison point of channel 1.

(1) System configuration

QD64D2
(X/Y00 to X/Y1F)
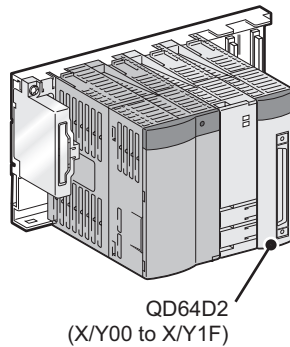
Figure 7.6 System configuration when the coincidence detection interrupt function is used

(2) Program conditions

(a) Interrupt pointer setting
Set the values at [PLC parameter] - [PLC system] - [Intelligent function module setting] - [Interrupt pointer setting] in the [Project data list] on GX Developer.
Set the values for this program example as shown below.
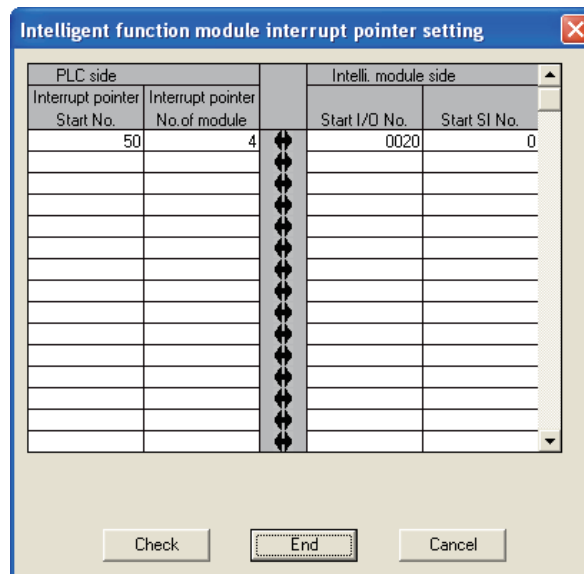
Figure 7.7 Intelligent function module interrupt pointer setting

(b) Devices used by users

Table 7.6 Devices used by users

Description	Setting value
Interrupt enabled flag storage for the IMASK instruction	D20 to D35

(3) Program example

An interrupt must be enabled using the IMASK instruction before using an interrupt pointer.

```
<Enabling interrupt of I50>
                                                                    ─[DI      ]
     SM402
     ─┤├─                                                ─[MOV    H4      D23  ]

                                                          ─[IMASK   D20  ]

                                                                    ─[EI      ]
     ┌ - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - ┐
     │                        QD64D2 program                                 │
     └ - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - ┘
                                                                    ─[FEND    ]
<Interrupt program>
I50
     ┌ - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - ┐
     │                       Interrupt program                               │
     └ - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - ┘
                                                                    ─[IRET    ]

                                                                    ─[END     ]
```
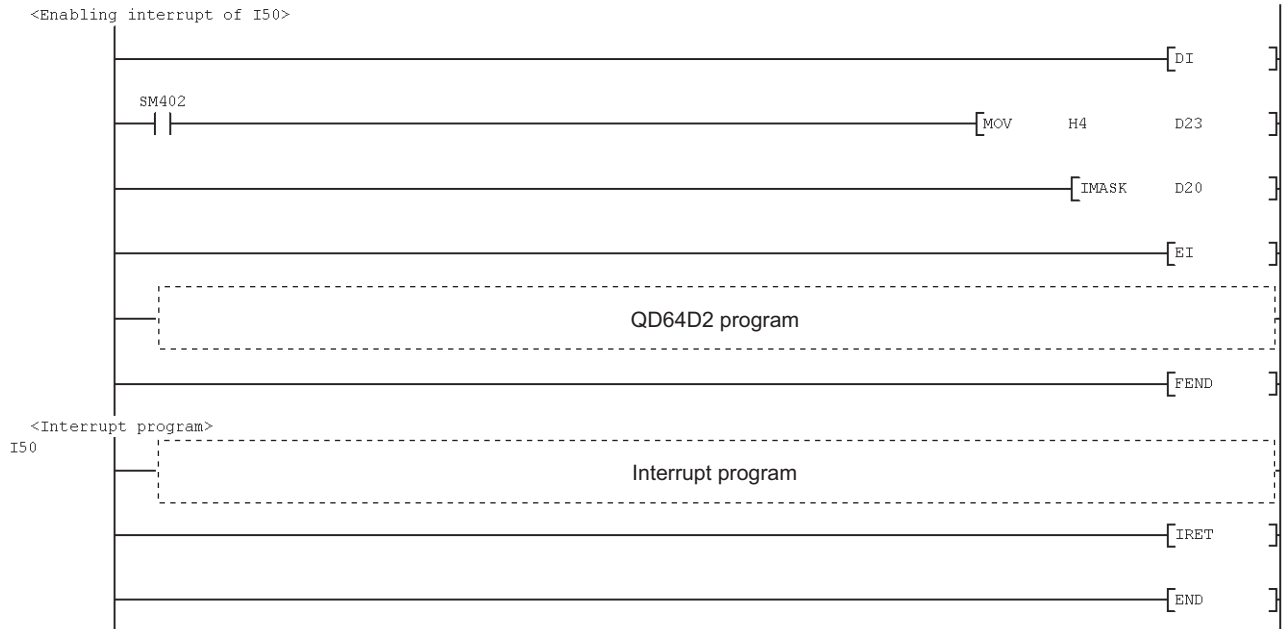
⊠ **POINT**

- When the above described program is executed, only I50 interrupt program is execution-enabled and other interrupt programs are execution-disabled.
  When executing interrupt programs other than I50, set the corresponding bit for interrupt program to be executed to 1 (enabled).
- For details of the IMASK instruction, refer to the following manual.

  ☞ MELSEC-Q/L Programming Manual (Common Instruction)

CHAPTER8   TROUBLESHOOTING

This chapter describes the troubleshooting, error code and warning code of the QD64D2.
Before performing a troubleshooting for the QD64D2, check that the CPU module does not have any errors.
For error details of the CPU module, refer to the following manual.

☞ QCPU User's Manual(Hardware Design, Maintenance and Inspection)

8.1   Error Processing and Recovery Methods

8.1.1   Checking error description using System Monitor of GX Developer

Error codes can be checked by selecting [Module's Detailed Information...] on the [System Monitor] screen of GX Developer.

(1) GX Developer operation

Select [Diagnostics] → [System Monitor] → [QD64D2] →   Module's Detailed Information...

(2) Checking error codes

Error code that is stored in the error code (Un\G18) is displayed in the [Present Error] field.(Either one of channels 1 and 2)

(By clicking the   Error History   button, error code of the present error on each channel is displayed in order of channel 1 to 2. Note that this is not a history.)
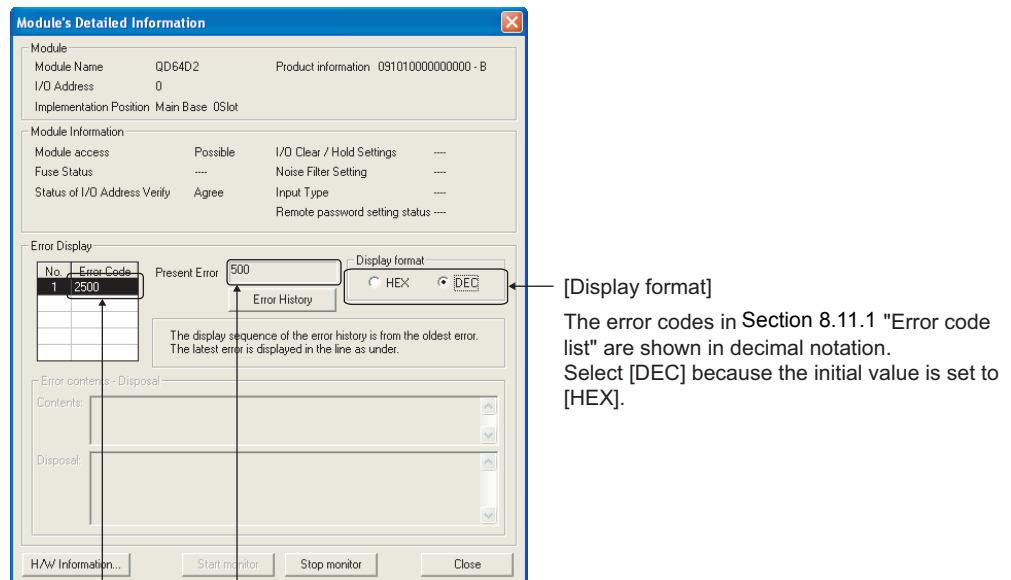
[Display format]

The error codes in Section 8.11.1 "Error code list" are shown in decimal notation.
Select [DEC] because the initial value is set to [HEX].

[Display contents]

[Present Error]
Indicates error code 500 "ring counter upper/lower limit value setting error".

Error code of the channel

Channel number that has an error
[2500] indicates that the error code 500 is occurring on CH2.

Figure 8.1 [Module's Detailed Information] screen

(3) Checking Module's Detailed Information

Check the status of LEDs and intelligent function module switch setting, and module information in [H/W status] on the [Module's Detailed Information] screen which can be displayed from [System Monitor] of GX Developer.

[Setting procedure]

Select [Diagnostics] → [System monitor...] → [QD64D2] →

[Module's Detailed Information...] → | H/W Information... |
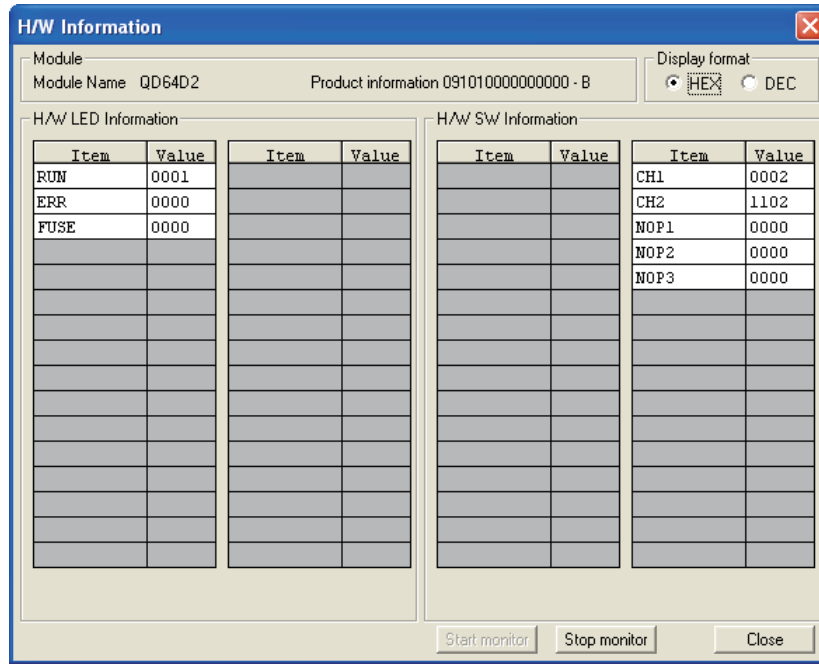
Figure 8.2 [H/W Information] screen

[H/W LED Information]

The following information is displayed on the [H/W LED Information] screen.

Table 8.1 H/W LED Information

Item	Signal	Value
RUN	"RUN" LED on the QD64D2	0: The LED is OFF. 1: The LED is ON.
ERR	"ERR." LED on the QD64D2	
FUSE	"FUSE" LED on the QD64D2	

[H/W SW Information]

The setting status of the intelligent function module switches is displayed.

Table 8.2 H/W SW Information

Item	Signal	Corresponding switch	Value
CH1	CH1 setting	Switch 1	For details, refer to Section 4.5 Intelligent Function Module Switch Setting.
CH2	CH2 setting	Switch 2	
NOP1	----	Switch 3	
NOP2	----	Switch 4	
NOP3	----	Switch 5	

8.1.2 When the RUN LED turns OFF

Table 8.3 When the RUN LED turns OFF

Check item	Action	Reference
Is the power supplied?	Check if the service voltage of the power supply module is within the rated range.	----
Is the capacity of the power supply module sufficient?	Calculate the consumption current of the modules mounted to the base unit such as CPU module, I/O module, and intelligent function module, and check that the current capacity is sufficient.	----
Is there a watchdog timer error?	Reset the programmable controller CPU and check that the RUN LED turns ON. If the RUN LED remains OFF even doing so, the QD64D2 is at fault. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.	Section 4.3
Are the modules correctly mounted to the base unit?	Check the module mounting status.	Section 4.1

8.1.3 When the RUN LED and ERR.LED turn ON

Table 8.4 When the RUN LED and ERR.LED turn ON

Check item	Action	Reference
Is there any errors?	Check the error code (Un\G18) of channels in use and take action described in Error Code List.	Section 8.11.1

8.1.4 When the RUN LED and FUSE LED turn ON

Table 8.5 When the RUN LED and FUSE LED turn ON

Check item	Action	Reference
Is the fuse of the external coincidence output part blown?	Please consult your local Mitsubishi representative, explaining a detailed description of the problem.	Section 4.3

⊠POINT

Even if the fuse of the external coincidence output part is blown, the FUSE LED does not turn ON unless a voltage is applied to the external coincidence output power supply terminal.

8.2 When the QD64D2 does not Start Counting

Table 8.6 When the QD64D2 does not start counting

Check item	Action	Reference
Do the LEDs of ϕA and ϕB turn ON by directly applying a voltage to the pulse input terminals of ϕA and ϕB using such as a voltage stabilizer?	If they turn ON, check the external wiring, encoder side and so on, and correct the error. If they remain OFF, it is a hardware failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.	Section 4.3 Section 4.4
Is the external wiring of ϕA and ϕB correct?	Check the external wiring and correct the error.	
Is the count enable command (Y06) turned ON?	Turn ON the count enable command (Y06) by the sequence program.	Section 3.3.2
Are the pulse input method and pulse input mode set with the intelligent function module switch setting the same?	Match the pulse input method with the pulse input mode made on the intelligent function module switch setting.	Section 4.5 Section 5.1

8.3 When the QD64D2 does not Normally Count

Table 8.7 When the QD64D2 does not normally count

Check item		Action	Reference
Does the input pulse waveform meet the performance specifications?		Check the pulse waveform with a synchronoscope. When the input pulse does not meet the performance specifications, input the pulse which meets the performance specifications.	Section 3.1
When the count value that is same with another channel is input, does the count result become the same with that of another channel?		If they differ, it is a hardware failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.	----
Noise reduction measures	Are the shielded twisted pair cables used for pulse input wiring?	Use the shielded twisted pair cables for pulse input wiring.	Section 4.4
	Has the measures against noise been taken to the adjacent devices and inside the control panel?	Take noise reduction measures such as attaching a CR surge suppressor to the magnet switch.	
	Is the distance between the high voltage equipment and pulse input line kept enough?	Bundle the pulse input lines and put them in a single tube, and keep a distance of 150mm (5.91 inch) or more with the power line even inside the control panel.	
	Does any noise come from the ground part of the QD64D2?	Separate the ground cable of the QD64D2 from the ground part. If the QD64D2 case touches to the ground part, separate it.	
Are the count value data treated in 32-bit binary in the sequence program?		Correct the sequence program so that the count value data can be treated in 32-bit binary.	Section 3.4 CHAPTER 7
Is the preset performed out of the count range of the ring counter? (Only for the ring counter function)		Perform the preset within the count range of the ring counter.	Section 3.4

8.4 When the Counter Value Coincidence No.1 (X02) or Counter Value Coincidence No.2 (X05) does not Turn ON/OFF

8.4.1 When selecting the coincidence output function

(1) When the counter value coincidence does not turn ON

Table 8.8 When the counter value coincidence does not turn ON (when selecting the coincidence output function)

Check item	Action	Reference
Has the coincidence output No.m point change request (Un\G10 and 11) been set to "1" (Change request)?	After changing the coincidence output No.m point setting (Un\G6 and 7, and Un\G8 and 9), set the coincidence output No.m point change request to "1".	Section 3.4
Is the coincidence signal No.m reset command (Y01 and Y02) ON?	Turn OFF the coincidence signal No.m reset command.	Section 3.3
Has the coincidence output No.m point setting (Un\G6 and 7, and Un\G8 and 9) been set to out of the count range of the ring counter? (Only for the ring counter)	Set the coincidence output No.m point setting value to within the count range of the ring counter.	Section 3.4

"m" indicates the coincidence output number.

(2) When the counter value coincidence does not turn OFF

Table 8.9 When the counter value coincidence does not turn OFF (when selecting the coincidence output function)

Check item	Action	Reference
Is the ON time of the coincidence signal No.m reset command (Y01 and Y02) 2ms or longer?	Set the ON time of the coincidence signal No.m reset command to 2ms or longer.	Section 3.3

"m" indicates the coincidence output number.

8.4.2 When selecting the continuous comparison function

Table 8.10 When the counter value coincidence does not turn ON/OFF (when selecting the continuous comparison function)

Check item	Action	Reference
Does the present value (Un\G12 and 13) coincide with the continuous comparison No.m point n setting (Un\G54 to 85, and 104 to 135) after an elapse of (continuous comparison No.m ON time setting (Un\G52 and 102) + 1ms)?	Change the setting so that the present value coincides with the continuous comparison No.m point n setting after an elapse of (continuous comparison No.m ON time setting + 1ms).	Section 5.3.2
Has the continuous comparison No.m point n setting been set to out of the count range of the ring counter? (Only for the ring counter function)	Set the continuous comparison No.m point n setting value to within the count range of the ring counter.	Section 5.2.1 Section 5.3.2
Does the relation of the scan time in the sequence program fall under the following condition? Scan time > continuous comparison No.m ON time setting (Un\G52 and 102)	Use the direct access input (DX) and so on to read out the counter value coincidence No.m (X02 and X05) within the time set by the continuous comparison No.m ON time setting (Un\G52 and 102).	Section 5.3.2 CHAPTER 7

"m" indicates the continuous comparison number.

8.5 When the Counter Value Coincidence No.1 (X02) or Counter Value Coincidence No.2 (X05) are Turned ON, but the Coincidence Output No.1 Terminal (EQU1) and Coincidence Output No.2 Terminal (EQU2) do not Turn ON

Table 8.11 When the counter value coincidence No.1 (X02) or counter value coincidence No.2 (X05) are turned ON but the coincidence output No.1 terminal (EQU1) and coincidence output No.2 terminal (EQU2) do not turn ON

Check item	Action	Reference
Is the coincidence output enable command (Y03) turned ON? (Only for the coincidence output function)	Turn ON the coincidence output enable command (Y03).	Section 3.3 CHAPTER 7
Is a voltage applied to the external coincidence output power supply terminal.	Apply a voltage to the external coincidence output power supply terminal.	Section 3.5 Section 4.4
Is the fuse blown?	If the FUSE LED is ON, the fuse is blown. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.	Section 3.5 Section 4.4
Is the external wiring of the coincidence output No.1 terminal (EQU1) and coincidence output No.2 terminal (EQU2) correct?	Check the external wiring and correct the error.	

8.6 When the Coincidence Detection Interrupt does not Occur

Table 8.12 When the coincidence detection interrupt does not occur

Check item	Action	Reference
Does the CPU module support the coincidence detection interrupt function?	Change the CPU module to the one which supports the intelligent function module event interrupt.	Section 2.1 (1)
If the setting made on [Interrupt pointer setting] of [Intelligent function module setting] in [PLC parameter] correct?	Check the intelligent function module interrupt pointer setting.	Section 5.3
Is the way to use the program execution control instruction, such as IMASK, correct?	Check the sequence program.	Section 5.3 CHAPTER 7
Is the counter value coincidence (X02 and X05) still ON? (Only for the coincidence output function)	Reset (OFF) the counter value coincidence No.m (X02 and X05) by the coincidence signal No.m reset command (Y01 and Y02) for the corresponding number.	Section 3.3.2

8.5 When the Counter Value Coincidence No.1 (X02) or Counter Value Coincidence No.2 (X05) are Turned ON, but the Coincidence Output No.1 Terminal (EQU1) and Coincidence Output No.2 Terminal (EQU2) do

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8.7 When the Coincidence Output Test Function Cannot be Executed

Table 8.13 When the coincidence output function cannot be executed

Check item	Action	Reference
Has the counter value comparison function selection been set to the coincidence output function?	While selecting the coincidence output function, the coincidence output test function cannot be used. To perform wiring check while selecting a coincidence output function, refer to procedure in Section 5.3.1 (2).	Section 5.3.1 (2)

8.8 When the Preset Cannot be Executed

8.8.1 When the preset cannot be executed by the preset command (Y04)

Table 8.14 When the preset cannot be executed by the preset command (Y04)

Check item	Action	Reference
Is the ON and OFF time of the preset command (Y04) 2ms or longer?	Set the ON and OFF time 2ms or longer.	Section 3.3
Is the external preset request detection (X08) ON?	Turn ON the external preset request detection reset command (Y08), and reset (OFF) the external preset request detection (X08). At the time, set the ON and OFF time of the external preset request detection reset command (Y08) 2ms or longer.	

8.8.2 When the preset cannot be executed by the preset input terminal (PRST)

Table 8.15 When the preset cannot be executed by the preset input terminal (PRST)

Check item	Action	Reference
Is the external wiring of the preset input terminal (PRST) correct?	Check the external wiring and correct the error.	Section 3.5
Is the interval after changing the preset value setting (Un\G4 and 5) until turning ON the preset input terminal (PRST) 2ms or longer?	Set the interval 2ms or longer.	Section 3.4
Is the external preset request detection (X08) ON?	Turn ON the external preset request detection reset command (Y08), and reset (OFF) the external preset request detection (X08). At the time, set the ON and OFF time of the external preset request detection reset command (Y08) longer than 2ms.	Section 3.3

8.9   When the Latch Counter Function Cannot be Executed

8.9.1   When the latch counter function cannot be executed by the latch counter execution command (Y07)

Table 8.16 When the latch counter function cannot be executed by the latch counter execution command (Y07)

Check item	Action	Reference
Is the ON and OFF time of the latch counter execution command (Y07) longer than 2ms?	Set the ON and OFF time 2ms or longer.	Section 3.3
Is the latch counter input terminal (LATCH) ON?	Turn OFF the latch counter input terminal (LATCH).	Section 5.5

8.9.2   When the latch counter function cannot be executed by the latch counter input terminal (LATCH)

Table 8.17 When the latch counter function cannot be executed by the latch counter input terminal (LATCH)

Check item	Action	Reference
Is the external wiring of the latch counter input terminal (LATCH) correct?	Check the external wiring and correct the error.	Section 3.5
Is the latch counter execution command (Y07) ON?	Turn OFF the latch counter execution command (Y07).	Section 5.5

8.10   When the Error Code (Un\G18)/Warning Code (Un\G19) Cannot be Reset

Table 8.18 When the error code (Un\G18)/warning code (Un\G19) cannot be reset

Check item	Action	Reference
Is the cause of the error/warning fixed?	Refer to the description and action columns in error code and warning code list, and fix the cause.	Section 8.11
Is the ON and OFF time of the error reset command (Y0D) 2ms or longer.	Set the ON and OFF time 2ms or longer.	Section 3.3

8.11 Action and Handling of Errors

8.11.1 Error code list

This section describes the descriptions and corrective actions for the errors detected by the QD64D2.

Table 8.19 Error code list

Error code	Description	Action	Operation at error	
			Error channel	Other channels
0	(Normal)	----	----	----
100	[Overflow error] The present value (Un\G12 and 13) exceeded the following range. -2147483648 to 2147483647 (Only for the linear counter function)	Perform the preset. (Refer to Section 5.4.)	The linear counter function stops counting.	The error does not affect other channels.
20m	[Continuous comparison No.m start point setting error] The continuous comparison No.m start point setting (Un\G50 and 100) is set to other than 1 to 16. "m" indicates the continuous comparison number where the error occurred.	Set a value from 1 to 16.	The continuous comparison cannot be started. (The error does not affect the other continuous comparison number.)	
21m	[Continuous comparison No.m repeat point setting error] The continuous comparison No.m repeat point setting (Un\G51 and 101) is set to other than 1 to 16. "m" indicates the continuous comparison number where the error occurred.	Set a value from 1 to 16.		
22m	[Continuous comparison No.m ON time setting error] The continuous comparison No.m ON time setting (Un\G52 and 102) is set to other than 1 to 10. "m" indicates the continuous comparison number where the error occurred.	Set a value from 1 to 10.		
300	[Count enable execution not possible error] The count enable command (Y06) is turned ON while one of the following is ON. •Coincidence output No.1 test command (Y0B) •Coincidence output No.2 test command (Y0C)	Turn OFF the coincidence output test command which is ON.	The linear counter function and ring counter function does not start counting.	

Table 8.19 Error code list (continued)

Error code	Description	Action	Operation at error	
			Error channel	Other channels
31m	[Continuous comparison No.m execution not possible error] The continuous comparison No.m execution command (Y09 and Y0A) is turned ON while one of the following is ON. •Coincidence output No.1 test command (Y0B) •Coincidence output No.2 test command (Y0C) "m" indicates the continuous comparison number where the error occurred.	Turn OFF the coincidence output test command, then turn ON the continuous comparison execution command.	The continuous comparison cannot be started. (The error does not affect the other continuous comparison number.)	The error does not affect other channels.
500	[Ring counter upper/lower limit value setting error] The count enable command (Y06) is turned ON under the following condition. (Ring counter lower limit value (Un\G0 and 1)) > (Ring counter upper limit value (Un\G2 and 3)) (Only for the ring counter function)	Set a value as follows. (Lower limit value $\leqq$ Upper limit value)	The ring counter function does not start counting.	
810	[Switch setting error] An invalid value is set in the switch setting for intelligent function module in GX Developer.	Set a correct value in GX Developer and perform [Write to PLC]. After that, power OFF then ON the programmable controller CPU or reset it. (Refer to Section 4.5.)	•All functions and counting are stopped. •Updating the external I/O status monitor is stopped. •The module READY (X00) turns OFF.	
820	[Programmable controller CPU error] An error occurred in the programmable controller CPU.	Power OFF then ON the programmable controller CPU or reset it.		
830	[Watchdog timer error of programmable controller CPU] A watchdog timer error occurred in the programmable controller CPU.			
840	[Module error] An error occurred in the module.	Power OFF then ON the programmable controller CPU or reset it. If an error occurs again, replace the module.		
850	[Hardware error] A hardware error occurred.	Replace the module.		
860	[Blown fuse error] The fuse of the external coincidence output part is blown.	•For replacement of fuse, please consult your local Mitsubishi representative. •When temporarily using the module with a blown fuse, do not apply a voltage to the external coincidence output power supply terminal and power OFF then ON or reset the programmable controller CPU.		

POINT

(1) When another error occurs during error occurrence, take the following action.
- When an error code from 100 to 500 occurs, the latest error code is ignored and the error code stored before the latest error code is held.
- When an error code from 810 to 860 occurs, the error code is overwritten as the latest one.

(2) The error code 810 is stored for each channel, and the error code from 820 to 860 is stored for all channels.

(3) After fixing the cause of the error, reset the error by the error reset command (Y0D). If the cause of the error is not fixed, the error is detected again.

1 OVERVIEW

2 SYSTEM CONFIGURATION

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8.11.2 Warning code list

This section describes the descriptions and corrective actions for the warnings detected by the QD64D2.

Table 8.20 Warning code list

Warning code	Description	Action	Operation at warning	
			Warning channel	Other channels
0	(Normal)	----	----	----
3m	[Coincidence output No.m test output not possible] The coincidence output No.m test command (Y0B and Y0C) is turned ON while one of the following is ON. •Count enable command (Y06) •Continuous comparison No.1 execution command (Y09) •During continuous comparison No.1 execution (X09) •Continuous comparison No.2 execution command (Y0A) •During continuous comparison No.2 execution (X0A) "m" indicates the continuous comparison number where the warning occurred.	Turn OFF the all signals listed on the left.	The coincidence output test cannot be started. (The warning does not affect the other coincidence output number.)	The warning does not affect other channels.

⊠POINT

- When another warning occurs during warning occurrence, the warning code is overwritten as the latest one.
- After fixing the cause of the warning, reset the warning by the error reset command (Y0D). If the cause of the warning is not fixed, the warning is detected again.

APPENDICES

Appendix 1   External Dimensions

(unit: mm (inch))
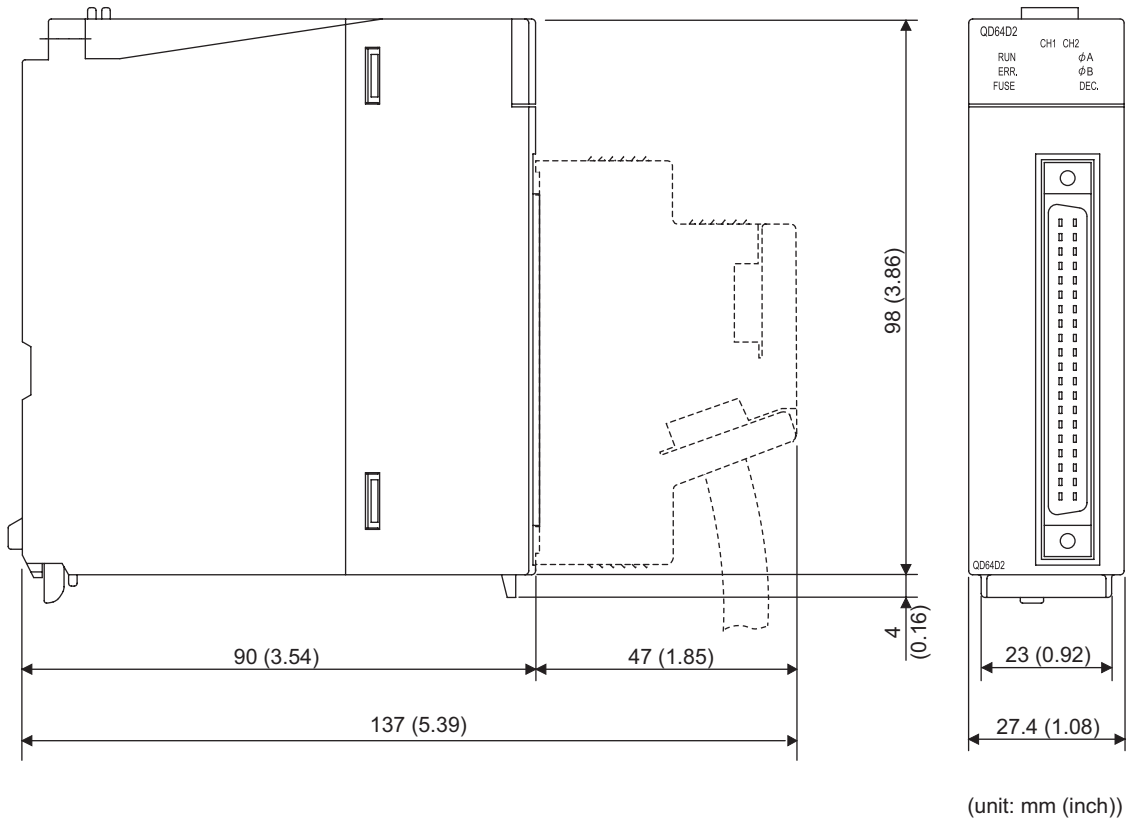
Appendix 2   Difference with the QD62D

Note that I/O signals, buffer memory assignment and external device interface (terminal layout) of this module is not compatible with the QD62D.
The terminal block conversion module (A6TBXY36) cannot be used with the QD64D2.

Memo

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Warranty

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company.

However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place.

Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

 [Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.
1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued.
Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation of damages caused by any cause found not to be the responsibility of Mitsubishi, loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products, special damages and secondary damages whether foreseeable or not , compensation for accidents, and compensation for damages to products other than Mitsubishi products, replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

MITSUBISHI ELECTRIC CORPORATION

When exported from Japan, this manual does not require application to the
Ministry of Economy, Trade and Industry for service transaction permission.

Specifications subject to change without notice.